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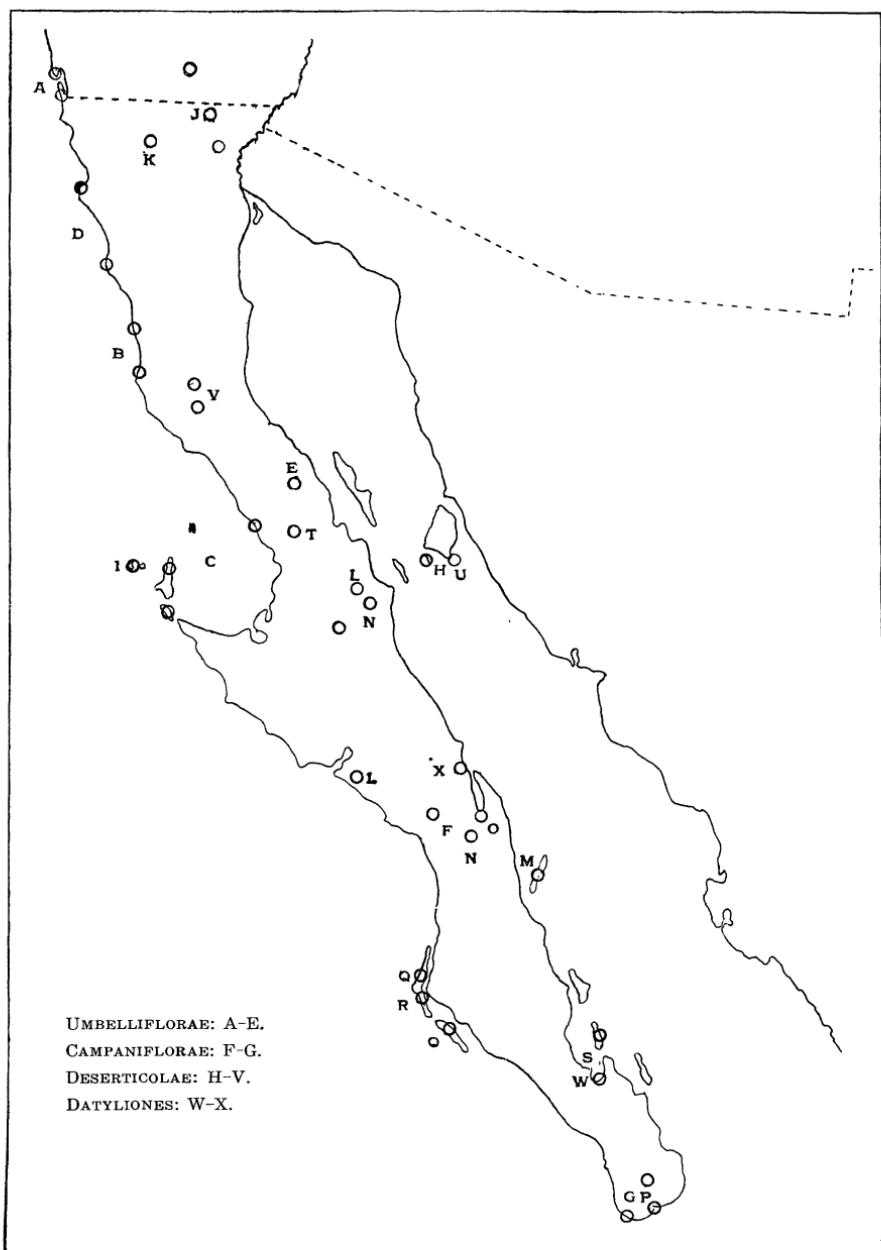
THE AGAVES OF LOWER CALIFORNIA.

BY WILLIAM TRELEASE.

In the spring of 1910, Dr. J. N. Rose, of the United States National Museum, sent me for determination eight specimens of *Agave* brought back from Lower California in 1905 by Messrs. E. W. Nelson and E. A. Goldman, of the Bureau of Biological Survey of the United States Department of Agriculture, on their return from a venturesome and trying reconnaissance of the peninsula, of which Mr. Nelson has recently published an interesting illustrated account.¹ Other tasks prevented me from more than casually examining this material until midsummer of 1911, when it was subjected to critical study, including a careful examination of the general literature of *Agave* and of specimens representing the groups to which the Lower Californian species belong or with which they might be compared. On the completion of this study I was further obliged by Dr. Rose with fourteen specimens which he himself had collected in the early part of 1911, under the auspices of the United States National Museum and the New York Botanical Garden, at landings effected during a cruise of the U. S. Steamer "Albatross" about the peninsula. An additional specimen collected by him in 1897, and twelve other sheets from the National Herbarium, were also placed in my hands subsequently, by Dr. Rose. The conclusions as to earlier-published species have been confirmed or corrected and the descriptions brought into comparability with those now first published, through the courtesy of Professor H. M. Hall and Mr. T. S. Brandegee, of the University of California—the latter of whom made extensive Lower Californian collections in 1889, 1890 and 1892, on which he has published,² who have obligingly sent me for examination twenty-two peninsular specimens including the types

¹ National Geographic Magazine. 22 : 443. May 1911.

² Proc. California Academy of Sciences. ii. 2 : 117, Nov. 12, 1889; and ii. 3 : 108, July 14, 1891 and 218, Nov. 10, 1892.



AGAVE IN LOWER CALIFORNIA.

of all of Mr. Brandegee's species. No small profit has been derived further from study of small plants collected this year by Dr. Rose, as part of his very large gathering of living succulents, and for which I am equally indebted to the officers of the National Museum and of the New York Botanical Garden. The study of all of this material has proved unusually interesting, and my sincere thanks are recorded for the privilege of making it, as well as for access to and use of the very full field notes and the photographs that accompany many of the specimens. Dr. Rose has also done me the favor of revising the manuscript, with the specimens in hand.

Lower California is essentially a desert, but it is relieved by a broken chain of mountains reaching an altitude of over ten thousand feet on part of which rainfall is sufficiently abundant and the prevalent high temperature sufficiently mitigated to permit forest development. The southern cape region is said to be blessed with summer showers, rarely experienced above. Mr. Brandegee has indicated a change in the character of the vegetation to the north and south of the divide between Calmalli and Cardon Grande, that of the north being more and that of the south less like the Californian flora. Mr. Watson long since called attention to the fact that the flora of the peninsula is Mexican rather than Californian in its general characters.

Agave is essentially a desert genus of plants, centering on the dry tableland of Mexico and rarely dropping into the rainy piedmont. Nevertheless, in some of its forms it occurs through the entire chain of West Indian islands, which are essentially arid in a part of their coast region at least, and its outlying representatives are found as far south as the upper Andean region, and as far north as Utah, in the United States, while its eastern and western limits are the oceans.

I have no knowledge of an agave native to an oceanic island, and water seems always to offer an effectual barrier to distribution in this genus. Even on the mainland, no species is known to have a range of very large extent with exception of the common lechuguilla, which, in fact, is rep-

resented by a series of closely allied succeeding forms in the extensive region over 100 miles wide and 700 miles long that it inhabits between western Texas in the United States and San Luis Potosi in Mexico. It is not surprising, therefore, that in arid Lower California the genus should be well represented and that the number of species thus far collected should nearly equal the number of localities from which collections have been made, nor that none should be known to occur in more than a rather narrowly limited region. There is no more reason for surprise in the fact that all which are yet known should be endemic, for the lower third of the Gulf, separating the peninsula from continental Mexico, is over 1,000 fathoms deep, pointing to a very long isolation, and 100-fathom depths continue through the remainder, almost to its head, so that connection with the mainland to the east appears to have been restricted for a very long time to at most a small extension of the desert land flanking the mouth of the Colorado River. The coastwise islands all stand well up on the 100-fathom shelf and some of them are parted from the peninsula by very shoal water. The indications, therefore, are that the Lower Californian agaves have entered from the north and not by crossing the Gulf and that those of the adjacent islands have been derived from the peninsula; and the general effectiveness of water barriers in the spread of the genus is such as to make it probable that the species found on the islands reached them at a period when they were joined to the adjacent land.

All of the known Lower Californian agaves belong to the paniculate subgenus *Euagave*. To the eye they fall into four groups: a compact, broad-leaved, large-toothed form, represented by *A. Shawii*, confined to the northern half of the peninsula and, with one exception, to its western coast; a more open typically narrow-leaved, often fragile-toothed form, comparable with *A. deserti* of the Colorado Desert, of wide occurrence and less uniform appearance than the preceding; a form with large recurving lanceolate leaves, moderately armed, occurring below the middle of the peninsula,

typically represented by *A. aurea*; and a form with dagger-like, heavy-prickled leaves, also confined to the lower half of the peninsula, of which *A. Datylia* is representative. These groups are fairly consistent in flowers and fruit except that a number of plants that resemble *A. Shawii* somewhat in growth prove on these characters to be more closely related to the very different looking *A. deserti*, around which cluster the largest number of forms. In the synopsis which follows, these groups have been made the basis of classification.

So far as is now known, these groups, like their component species, are essentially endemic. The first, Umbelliflorae, is most closely allied to the boreal set of species of which *A. Parryi* is a well-known representative. The second, Deserticolae, centers about *A. deserti*, which in its typical form occurs in the desert shortly north of the boundary; but the occurrence of two species, not placeable elsewhere, on islands that clearly belong to the mainland and not the peninsula, gives reason to suppose that this group may be found to have mainland representatives not yet made known. The third, Campaniflorae, though notably different, can be compared with nothing as closely as with *A. Palmeri* of the Arizona region, which possesses an undescribed equivalent in Durango. The fourth, Datyliones, is of the stock to which the Sisalanae of Yucatan and the Tequilanae of southern and western Mexico belong, and apparently more closely related to the former. The first three groups, which comprise nearly all of the species known for Lower California, thus give indication in their relationships of the probability, pointed by geographic considerations, of their entry around rather than across the Gulf; but this conclusion is not evident in case of the Datyliones, and much less evident for the Campaniflorae than for the first two groups.

It is interesting that *Agave*, like *Nolina*, *Yucca*, *Fouquieria*, etc., seems to have passed into Lower California from the northeast without entering California except in its southernmost desert part, while close allies of the first (*Manfreda*, widely distributed through Mexico and sparingly represented

in the United States east of the divide) and of the second (*Dasyliion*, characteristic of the backbone of the continent as far north as Texas and Arizona) have failed to pass the desert; the wide-spread genus *Yucca*, which has followed *Agave* in its penetration of the peninsula, though absent from California, is represented in the flora of that state by two local monotypic genera; and *Fouquieria* is accompanied in Lower California by its odd derivative, *Idria*.

The first definitely known *Agave* of Lower California—or Baja California, as it is called in Spanish—was described by Engelmann in 1875, under the name *A. Shawii*. In 1885 a related species, *A. sebastiana*, was made known by Greene. In 1888 Baker published the description of a third, *A. Pringlei*, which had been distributed in Pringle's *exsiccatae* of 1882 under this manuscript name, given it by Engelmann, who, however, failed to satisfy himself subsequently that it was distinct from *A. deserti* of the Colorado Desert, which he had previously characterized. Without description, Mr. Baker also published in 1888 the name *A. scaberrima* as applied to a plant in the Peacock collection that had flowered in 1881 and may have been the similarly named plant listed by Verschaffelt as early as 1869; no indication of its origin is given, but it is mentioned under *A. Pringlei* as allied. It can scarcely have been from Lower California, and remains unknown since *A. asperrima*, which has been given this name by error, could hardly have been compared with a species related to *A. deserti*. In 1889 Mr. Brandegee doubled the number of species accredited to Lower California by publishing *A. aurea*, *A. margaritae* and *A. sobria*. To his introduction of living plants is also attributable mention of the name *A. spiralis* in 1900, though this is yet uncharacterized. In this same year *A. Datylis* was listed, but it was not until 1902 that Dr. Weber described it.

The present study increases the number of species to twenty-two. Considering the sometimes misleading habit resemblances of some of them, it is probable that others will be found to have been passed by in the territory already explored. The small part of the peninsula covered by them

as they are now known in the herbarium at once points to the probability of other equally interesting discoveries and indicates the need of definite outlining of the extremely limited ranges of most of those now recognized.

In his exploration of the San Benito islands Dr. Palmer noticed on West San Benito two representatives of this genus, but he collected neither; his observation was recorded by Vasey and Rose (Contr. U. S. Nat. Herb. 1: 20. 1890) in their account of the plants of those islands. Though there is no improbability of more than one species of the set of *A. Shawii* being found on the rather isolated islands and the mainland about Sebastian Viscaino Bay—as actually appears to be the case on the scarcely detached islands about Magdalena Bay, Dr. Rose though he had the occurrence of a second species in mind when he visited San Benito last spring did not then note its presence and I am unable to see anything except *A. sebastiana* in the herbarium material from that region. Among the living plants brought back by Dr. Rose, however, are small plants from San Benito, bearing the field number 41, which are very different from the herbarium material of the corresponding number, 16041, representing *A. sebastiana*. No doubt these living plants are of the second species noted by Dr. Palmer, which, though aberrant, is obviously of the Deserticolae, and for completeness is now given name and place, though its described characters unfortunately are comparable with those of a large majority of garden agaves and probably far from representative of mature plants.

One curious distributional fact is that the Campaniflorae and Datyliones are each represented by slightly differentiated species, peculiar respectively to the Cape region and the mid-peninsula.

All of the Lower Californian agaves referred to in such publications as I have seen are accounted for in the following pages, except *A. spiralis*, which Mr. Brandegee tells me was found wild about La Paz and in his garden at San Diego responded to the care given it by developing into a truly arborescent plant about 3 m. high which suckered freely so

as to form a massed growth, but never flowered. Subsequent search about La Paz by himself and others has failed to result in the rediscovery of anything comparable with this cultivated specimen or recognizable as *A. spiralis*, which really appears to be scarcely distinguishable from *A. decipiens* of Florida and the status of which on the western side of the continent must await further study.

As on the Mexican mainland, mezcal is made from some of the species. Mr. Brandegee records that *A. aurea* is put to this use, while he was led to name another species of the same region *A. sobria* because it was said not to be so used. No doubt fiber is extracted locally for domestic purposes from a number of the species. In connection with his collection of the long-leaved plant which I have named *promontorii*, Dr. Rose notes that it is probably used for fiber because he found that the young cores had been cut out frequently. It is possible that the references to *A. aurea* as a fiber plant really pertain to this, its Cape representative; in any event it appears from the published statements that efforts have been made to cultivate for fiber what was taken for *A. aurea*. In 1897 Dr. Rose made a collection of the true henequen, *A. fourcroydes*, in a yard at La Paz, but I lack information that it has been grown on a large scale in the peninsula. When, in 1902, Dr. Weber (Bull. Mus. Hist. Nat. 8: 218-224) published the brief account of the agaves of western Mexico and Lower California in which he named the principal species grown for the commercial production of mezcal about Tequila *A. tequilana*, he illustrated its flowering aspect by a photograph made by M. Diguet in Lower California, where it was said to be cultivated frequently. A little above a year since, while studying the numerous and diverse mezcal species of western Mexico, I learned from Consul Lucien Sullivan of La Paz, through the kindly offices of our national Secretaries of State and Commerce and Labor, that a plantation of about 100,000 plants, occupying some 75 acres of ground, exists at San Antonio, about fifty miles southeast of La Paz, from which between 18,000 and 20,000 liters of mezcal are made annually. Specimens of the plant

cultivated at San Antonio, which Mr. Sullivan secured through the interest of the Chief of the Revenue Stamp Office at La Paz, Sr. Talamantes, show that it is not an indigenous species, but one introduced from the mainland, though it proves not to be the "mezcal azul," *A. tequilana*, as supposed when it was used in illustration of that species, but it appears to be the "cuchara" form, which differs in a number of characteristic respects from *A. tequilana*, though as yet unnamed botanically. Mr. Sullivan further states that the fiber of this cultivated mezcal is extracted to a limited extent and that efforts are being made to increase this use of the plant.

SYNOPSIS.

Shortly caulescent but leafy throughout in a globose or ellipsoid head. Leaves hard-fleshy, stiff and straight, typically short and broad: spine stout, openly grooved, decurrent: prickles large, often confluent. Scape very stout, covered by deltoid appressed bracts. Panicle short with stiff nearly horizontal almost simple branches bearing large funnel-shaped flowers in dense almost head-like clusters. Filaments inserted within the tube. *UMBELLIFLORAE.*

Flowers almost sessile in dense bracted clusters: filaments inserted about the middle of the tube. Capsules with very thick exocarp surrounding a core. *A. Shawii.*

Flowers short-pedicelled on longer secondary branches of the panicle: filaments inserted about the upper fourth of the tube. Capsules woody.

Spines sinuous and rather slender. *A. Orcuttiana.*

Spines nearly straight, elongated or very stout if short.

Prickles gradually tapering from the base. *A. sebastianiana.*

Prickles much widened at base.

Capsules oblong: seeds large. *A. pachyacantha.*

Capsules pyriform: seeds moderate. *A. Goldmaniana.*

Acaulescent. Leaves fleshy, elongated and outcurved: spine stout, narrowly grooved, shortly decurrent: prickles rather large, on fleshy prominences. Scape stout, with triangular recurving bracts. Panicle ample, decompound, with medium-sized golden bell-shaped flowers. Filaments deep-seated. *CAMPANIFLORAE.*

Perianth-tube half as long as the segments. *A. aurea.*

Perianth-tube rather deep, two-thirds as long as the segments.

A. promontorii.

Acaulescent. Leaves fibrous-fleshy, stiff, straight or falcate, typically narrow: spine typically slender and narrowly grooved, decurrent: prickles usually moderately large, sometimes friable. Scape slender, with triangular suberect bracts. Panicle short with rather

simple slender ascending branches and medium-sized or small yellow cup-shaped flowers, usually very short-tubed. Filaments inserted nearly in the throat.

DESERTICOLAE.

Leaves triangular or narrowly lance-oblong.

Prickles close-set, minute.

Friable, almost without cusps.

A. dentiens.

firmer, with sharp but short cusps.

A. disjuncta.

Prickles moderately distant and developed.

Spine nearly straight. Perianth segments about 15 mm.

Leaves moderately wide with fairly strong spine.

Margin rather repand: prickles gradually tapered.

Ovary flask-shaped, short. *A. deserti.*

Ovary fusiform, elongated. *A. consociata.*

Margin nearly straight: prickles lenticular at base.

Ovary fusiform, exceeding the perianth.

A. Pringlei.

Leaves narrow with very slender spine: margin mostly repand.

Pedicels racemose. Leaves rough. *A. cerulata.*

Pedicels capitate. Leaves smooth. *A. carminis.*

Spine? Perianth segments fully 20 mm. long. Leaves smooth.

A. sobria.

Spine tortuous. Leaves rough.

A. affinis.

Leaves broadly lanceolate or oblanceolate with rather close-set short firm dark prickles.

A. Brandegeei.

Leaves broadly lanceolate or oblanceolate with rather distant large firm prickles.

Prickles moderately wide, little dilated at base.

Spine at first chestnut, nearly straight. Prickles relatively short.

A. margaritae.

Spine from dull red becoming ashen. Prickles long, often curved like fish-hooks.

A. connochaetodon.

Prickles very wide, often much dilated below.

Spine tortuous: margin often deeply repand. Perianth segments short.

A. Roseana.

Spine nearly straight: margin scarcely repand. Perianth segments long.

A. avellanidens.

Leaves oblong to ovate-oblong. Spine conical, straight, round-grooved.

Prickles long and firm.

A. subsimplex.

Prickles short and friable.

A. Nelsoni.

Acaulescent. Leaves fibrous-fleshy, stiff, straight, dagger-shaped: spine strong, grooved below, scarcely decurrent: prickles heavily triangular. Scape slender. Panicle narrowly oblong, with greenish tubular flowers. Filaments deep-seated.

DATYLIONES.

Spine grooved at base only. Filaments long.

A. Datyllo.

Spine grooved toward the middle. Filaments short.

A. vexans.

AGAVE SHAWII Engelmann, Trans. Acad. St. Louis. **3** : 314, 370. *pl. 2-3*, 579. *pl. 4*, 1875; Bot. Works. 311, 315. *ff.*—Gartenflora. **25** : 155; **26** : 164. *pl. 905*.—Belg. Hort. **1887** : 93.—Hamburg. Gart. Zeit. **1877** : 376.—Baker, Gard. Chron. n. s. **7** : 717; Handbook Amaryllid. 172; Kew Bull. **1892** : 3 and Add. Ser. **2** : 219.—Peacock, List. 2.—Orcutt, West Amer. Scientist. **4** : 68; **7** : 96.—Palmer, Amer. Journ. Pharm. **50** : 588.—Terracciano, Primo Contributo. 49.—Ricasoli, Utilita dei Giardini d'Aclimazione. 9.—Nicholson, Dict. **1** : 41; Dict. Prat. **1** : 86.—[Handbook] Mo. Bot. Gard. **1893**. *frontispiece*.—Kew Hand List Tend. Monocot. 121.—Rose in Bailey, Cyclop. **1** : 34.—Cactus Journ. **2** : 181. *f.*—Segura, El Maguey. 4 ed. 71.—Müller, Bot. Zeit. Abt. I. **67** : 94, 113, 135.

Agave sp. Harwood, New Cr. in Plant life. 163. *f.*

A. Schawii Simon, Cat. [1900]: 16.

A. Shawii Menand, Cat. Pl. Albany. 20.—L. DeSmet, Cat. 10 : 35; 11 : 9.—DeSmet Frères, Cat. 25 : 9.—Gardening Ill. **15** : 21.

Cespitose, shortly caulescent (scarcely 1 m.), leafy throughout. Leaves smooth, green, rather glossy, ovate or lance-ovate, acuminate, openly concave, $6-12 \times 20-50$ cm., stiffly erect-spreading: spine acicular, flexuous, decidedly reddish, $3-6 \times 20-40$ mm., very openly grooved almost to the end, long-decurrent: prickles at first glossy garnet, 10-25 mm. apart, very large, often 10-15 mm. long, variously curved or even hooked and following the leaf convexity, elongated-triangular, somewhat abruptly widened to about 10 mm. at base, the intervening often continuously horny margin rather repand. Inflorescence about 3 m. high, the upper third or less ovoid-paniculate: scape stout: bracts deltoid, subimbricated, appressed: branches not very numerous, stout, moderately long, nearly horizontal, subsimple or very shortly tripartite with almost capitate bracted clusters: pedicels very short, much thickened in fruit. Flowers greenish yellow, slightly fetid, 70-90 mm. long: ovary 30-40 mm. long, subfusiform: tube openly conical, 15-20 mm. deep: segments attenuate from a wide base, about 8×20 mm., more or less equaling the tube and half as long as the ovary: filaments inserted about the middle of the tube, 55-60 mm. long and nearly thrice as long as the segments. Capsules oblong, $20-25 \times 50-70$ mm., strongly beaked but scarcely stipitate, with unusually thick exocarp surrounding a papery core: seeds $7 \times 8-9$ mm.

Coast of extreme southwestern California and adjacent Lower California.—*Shawii*,—Henry Shaw, founder of the

Missouri Botanical Garden, in whose establishment the species first flowered in cultivation.—*Map* (A). *Pl. 19-21.*

Specimens examined: South of San Diego, at the Initial Boundary Monument (*Hitchcock*, 1875,—the type; *Palmer*, 1875; *Parry*).

Agave Orcuttiana Trelease.

A. Shawii Brandegee, Proc. Cal. Acad. ii. 2 : 207. 1889.

Aspect of *A. Shawii*, but the more or less reclinate leafy trunk as much as 3 m. long. Leaves smooth, rather green, lance-elliptical, somewhat acuminate, $6-10 \times 15-30$ cm.: spine acicular, flexuous, dull gray, $4 \times 20-25$ mm., openly grooved to beyond the middle, long-decurrent: prickles similarly colored, about 10 mm. apart, usually large, sometimes 15 mm. long, variously curved or hooked, narrowly triangular, obliquely lunate widened into the nearly straight margin. Inflorescence paniculate: pedicels about 5 mm. long. Flowers about 75 mm. long: ovary 35-40 mm. long, subfusiform: tube conical, 12-15 mm. deep: segments attenuate from a wide base, about 7×20 mm., one-third longer than the tube and half as long as the ovary: filaments inserted about the upper third of the tube, about 50 mm. long and more than twice as long as the segments. Capsules?: seeds 6×8 mm.

Coast of northwestern Lower California.—*Orcuttiana*,—C. R. Orcutt, an earnest collector and student of the plants of California and Lower California.—*Map* (B). *Pl. 22.*

Specimens examined:—San Quintin (*Orcutt*, April 14, 1886,—the type). Rosario (*Orcutt*, Feb., 1883,—a leaf with small, close-set prickles).

AGAVE SEBASTIANA Greene, Bull. Cal. Acad. 1 : 214. 1885:
Pittonia 1 : 198, 208.

? *A. applanata* *Parryi* Purpus, Monatsschr. Kakteenkunde. 9 : 36; Cactus Journ. 2 : 39.

Habit of *A. Shawii*. Leaves smooth, glaucous, ovate to lanceolate, not very acuminate, openly concave, $6-10 \times 15-30$ cm., stiffly erect-spreading: spine variously conical, nearly straight, graying or darkening from rather dull red-brown, 5×20 to 30 or as much as 50 mm., openly grooved to beyond the middle, long-decurrent: prickles similarly colored, at first glossy, usually 10-15 or 20 mm. apart, 3-5 or even 10-15 mm. long, usually rather straight, retrorse below, narrowly triangular, their more or less lunate or lenticular bases connected by the straight or deeply notched horny margin. Inflorescence about 2 m. high, sometimes almost corymbose: scape stout: bracts not imbr-

cated, suberect: branches rather few, stout, ascending, compound: pedicels 5—often 10 or 15 mm. long. Flowers yellow, less densely aggregated than in *A. Shawii*, 60–85 mm. long: ovary 35–50 mm. long, oblong-fusiform: tube very openly conical, 12–17 mm. deep; segments attenuate, about 9×20 mm., longer than the tube but little more than half as long as the ovary: filaments inserted about the upper third of the tube, 50 mm. long, more than twice as long as the segments. Capsules with hard thick walls, very large, about 30×60–80 mm., beaked but scarcely stipitate: seeds very large and glossy, 7×11 mm.

Coast of west-central Lower California.—*Sebastiana*,—from its occurrence about Sebastian Viscaino Bay.—*Map (C)*. *Pl. 23-26*.

Specimens examined:—Cedros Island (*Greene*, May 1, 1885,—a co-type; *Brandegee*, Apr. 1, 1897; *Rose*, 16122, Mar. 10, 1911). San Benito Island (*Anthony*, 264, 1897; *Rose*, 16041, Mar. 9, 1911). Sta. Rosalia Bay (*Anthony*, 145, Aug. 16, 1896).

Young plants collected on Cedros Island by Dr. Rose under his field number 122, and grown at the New York Botanical Garden under the number 34174, for which, as for living representatives of nearly all of Dr. Rose's agaves of 1911 I am indebted to him and Professor Britton, are decidedly granular-roughened, and rather noticeably lined with darker green over the fibro-vesicular bundles which are closely surrounded by chlorenchyma. In variation of outline and marginal arming this and the following differ from the two preceding species, from either of which some leaves are indistinguishable.

***Agave pachyacantha* Trelease.**

Aspect of *A. Shawii*. Leaves smooth, rather gray, elliptical or broadly lanceolate, acuminate, 10–12×25–40 or even 75 cm.: spine nearly straight, stoutly conical, chestnut becoming dull or brownish gray, 6–9×25–40 mm., very openly grooved, long-decurrent: prickles similarly colored, about 15 mm. apart, large, about 10 mm. long, prevailingly retrorsely curved, heavily triangular, rather abruptly widened into the margin or where this is repand their heavy bases lunate dilated to a width of 10–15 mm. on the tops of the fleshy prominences. Inflorescence paniculate; pedicels about 5 mm. long. Flowers 75–80 mm. long; ovary about 35 mm. long, subfusiform-oblong: tube conical, 15 mm. deep: segments gradually acuminate, 7–8×25–30 mm., nearly

twice as long as the tube and approaching the ovary in length: filaments inserted about the upper fourth of the tube, 60-90 mm. long and about three times as long as the segments. Capsules thin-walled, oblong, 20 \times 60 mm., long-beaked, but not stipitate: seeds 5-6 \times 7-8 mm.

Northwestern Lower California, in the coast region.—*Pachyacantha*,—thick-spined, because of the terminal leaf spine.—Map (D). Pl. 27, 28.

Specimens examined:—Punta Banda, Todos Santos Bay (*Orcutt*, Jan. 24, 1883,—the type). Cape Colnett (*Brandegee*, May 1893).

Agave Goldmaniana Trelease.

Aspect of *A. Shawii*. Caulescent, the more or less reclinate trunk leafy throughout. Leaves smooth, gray?, lance-ovate or lanceolate, acuminate, openly concave, about 10 \times 50 cm., stiffly erect-spreading: spine nearly straight, half conical, dull blackish gray, 7 \times 40 mm., very openly grooved almost to the end, long-decurrent: prickles similarly colored, 15-30 mm. apart, often 10 mm. long, rather gently variously curved, heavily triangular, lunately widened into the little-repand margin or confluent. Inflorescence 5-7 m. high, the upper third broadly ovoid-paniculate: scape stout: bracts deltoid, scarcely imbricated, erect; branches rather numerous, nearly horizontal, shortly tripartite: pedicels scarcely 5 mm. long. Flowers deeply funnel-form, as shown by photographs. Capsules narrowly oblong-pyriform, about 20 \times 50 mm., beaked and somewhat stipitate, not very thick-walled: seeds glossy, 4 \times 6 mm.

Eastern Lower California, in the desert.—*Goldmaniana*,—E. A. Goldman, an experienced student, collector and photographer of the plants and animals of tropical North America. Yubai (*Nelson & Goldman*, 7151, 1905).—Map (E.) Pl. 29-31.

Entirely out of the region affected by other allies of *A. Shawii*, and in the desert association of *A. Nelsoni*, etc.

'AGAVE AUREA Brandegee, Proc. Cal. Acad. ii. 2: 207. 1889;
—Weber, Bull. Mus. Hist. Nat. 8: 223.

Agave sp. Brandegee, Proc. Cal. Acad. ii. 2: 119.

? *Agave* Maguey del Campo. Simon, Cat. [1900]: 16.

Not cespitose, acaulescent. Leaves smooth, grayish green, lance-oblong, acuminate, openly concave, becoming 10-15 \times 75-100 cm.: outcurved-ascending: spine conical or somewhat awl-shaped, slightly curved, from glossy chestnut sometimes becoming dull gray, 3-5 \times 20-30 mm., rather narrowly grooved below the middle, decurrent for about its own length: prickles similarly colored, mostly 10-20 mm. apart, very unequal, 4-8 mm. long, triangular, lunately enlarged onto

the tops of fleshy prominences between which the margin is usually concave, mostly curved or somewhat hooked, especially upwardly. Inflorescence 2-4 m. high, the upper half paniculate: scape stout: branches numerous, elongated, openly branched: pedicels scarcely 5 mm. long. Flowers golden yellow, goblet-shaped, 45-50 mm. long: ovary 20-25 mm. long, scarcely equaling the perianth, oblong-fusiform: tube 8 mm. deep: segments about $6 \times 15-20$ mm., typically more than twice as long as the tube: filaments inserted below the middle of the tube, about 40 mm. long and twice as long as the segments. Capsules oblong, 20×55 mm., shortly and obscurely stipitate and beaked: seeds glossy, broad, 6×8 mm.

Eastern Lower California.—*Aurea*,—golden, because of the color of its flowers. *Map (F). Pl. 32-34.*

Specimens examined:—Purisima (Brandegee, Feb. 13, 1889,—the type). Comondu (Nelson and Goldman, 7274, Nov. 6, 1905, with deeper tube and shorter lobes than the type).

If the name *aurea* were to be displaced because of its earlier application as a specific name to the variegated century plant (Jolyclerc, Syst. Sex. des Végét. 1: 268. 1799), this type of a most striking group of Lower Californian agaves might well be called *A. campaniflora* because of the characteristic form of its flowers.

Agave promontorii Trelease.

A. aurea Brandegee, Proc. Cal. Acad. ii. 3: 174. 1891.—? Dodge, Rept. Fiber Invest. 9: 44.—? De Laet, Cat. 1904: 38; 1906: 30.—? Braun, Pflanzer. 2: 219. —? Rose, Contr. U. S. Nat. Herb. 5: 247.—? Bois & Gallaud, C. Rend. Acad. Paris. 141: 1033.—? Endlich, Beihefte Tropenflanzer. 9: 281.

Agave sp. Brandegee, Proc. Cal. Acad. ii. 3: 227. no. 728.

Aspect of *A. aurea*. Leaves more glaucous with rather heavier and more curved and awl-pointed spine but similar prickles. Inflorescence 4-6 m. high, the upper half or two-thirds paniculate: scape very stout: bracts not overlapping, spreading: branches numerous, decompound, the lower somewhat recurved: pedicels scarcely 5 mm. long. Flowers golden, cup-shaped, 50-55 mm. long: ovary 25-30 mm. long, finally exceeding the perianth, rather oblong: tube 10-12 mm. deep: segments about $8 \times 10-15$ mm., scarcely one-half longer than the tube and sometimes barely equaling it: filaments inserted about the lower third of the tube, 40-45 mm. long, and about thrice as long as the segments. Capsules shortly pyriform-oblong, $15-20 \times 30-35$ mm., rather stipitate, beaked: seeds narrow, $4-5 \times 6-9$ mm.

Southern Lower California.—*Promontorii*,—of the cape, from its locality.—*Map (G)*. *Pl. 35-37*.

Specimens examined:—Sierra de la Laguna (*Brandegee*, Apr. 26, 1892; *Nelson and Goldman*, 7437, Jan. 21, 1906,—the type). Cabo San Lucas (*Brandegee*, Mar. 18, 1892; *Rose*, 16326, Mar. 23, 1911; *Grabendorfer*, 1899; and cultivated at San Diego by *Brandegee* in 1903). San Jose del Cabo (*Purpus*, Jan.-March 1901,—intermixed with *A. Brandegeei*).

Dr. Rose assures me that the coastwise plants are less massive than the Goldman photograph shows the type to be, and further material may prove them to be separable.

***Agave dentiens* Trelease.**

Somewhat cespitose, acaulescent. Leaves spreading, glaucous gray-green, transversely banded, essentially smooth, elongated-triangular, gradually acute, concave, becoming channeled near the end, $3-5 \times 30-50$ cm., very thick and aloe-like; spine triquetrously conical, nearly straight, ashen or by abrasion dull light brown, $3-4 \times 20-30$ mm., involutely slit to beyond the middle, usually very long-decurrent: prickles dingy brown or whitish, 5-10 mm. apart, scarcely 1 mm. long, mammaeform, very weak and friable, the intervening margin straight. Inflorescence 3-4 m. high, more than the upper half paniculate with few slender outcurved-ascending branches irregularly branched at the end: pedicels slender, scarcely 5 mm. long. Flowers? Capsules light brown, glaucous, 20×50 mm., stipitate and beaked: seeds?

Gulf Islands of Sonora rather than Lower California.—*Dentiens*,—teething, because of the rudimentary prickles on the margins of its leaves.—*Map (H)*. *Pl. 38-40*.

Specimens examined:—San Esteban Island (*Rose*, 16819, Apr. 13, 1911,—the type).

The least prickly of the agaves here considered: more likely to have entered by way of the Mexican mainland and Tiburon Island than through the peninsula, from which San Esteban Island is separated by very deep water; perhaps not really of the same alliance as the species centering about *A. deserti*.

***Agave disjuncta* Trelease.**

? *Agave* sp. *Vasey & Rose*, *Contr. U. S. Nat. Herb.* 1:20.

Habit? Leaves ascending, glaucous, smooth, oblong-triangular, concave: spine acicular, nearly straight, slit-grooved to the middle,

somewhat decurrent: prickles brown, moderately distant, minute, triangular with the cusps upcurved above and recurved below. Inflorescence, flowers and fruit unknown.

Pacific Islands of middle Lower California.—*Disjuncta*,—isolated, because of its occurrence apart from what appear to be its closest relatives.—*Map* (I).

Specimens examined:—San Benito Island (*Rose*, 41, 1911, —small living plants only).

Closely comparable, in young specimens, with *A. dentiens* only, from which it differs in its firmer more acicular prickles: differing from other known *Deserticolae* in the small size of its prickles.

AGAVE DESERTI Engelmann, Trans. Acad. St. Louis. **3** : 310, 370. 1875; Bot. Works. 309, 316.—*Gartenflora*. **25** : 154.—L. de Smet, Cat. 10 : 1, 31, 33.—*Baker, Gard. Chron. n. s. 7* : 717; *Handbook Amaryllid.* 172; *Kew Bull.* **1892** : 3, and Add. Ser. **2** : 219.—*Ricasoli, Bull Soc. Tosc. Ort.* **3** : 212.—*Peacock, List. 2.*—*Palmer, Amer. Journ. Pharm.* **50** : 588.—*Oreutt, Gard. & For.* **3** : 450; *W. A. Sci.* **6** : 22; **7** : 95.—*Terracciano, Primo Contributo.* 49.—*Nicholson, Dict.* **1** : 40; *Dict. Prat.* **1** : 82.—*Dodge, Rept. Fiber Invest.* 9 : 46. f. 10.—*Mulford, Rept. Mo. Bot. Gard.* **7** : 79. *pl. 33-34.*—*Kew Hand List Tend Monocot.* 111.—*Rose in Bailey, Cyclop.* **1** : 34.—*Segura, El Maguey.* 4 ed. 72.—? *Braun, Pflanzer.* **2** : 219.—*Endlich, Beihefte Tropenpfl.* **9** : 279.—*Mittheil. D. Dendrol. Ges.* 2 ed. 191.—*Abrams, Bull. N. Y. Bot. Gard.* **6** : 321.
A. americana Emory, Notes Milit. Recon. 104, 152. 1848.
A. deserti humilis L. de Smet, Cat. 10 : 1, 31, 33.

Densely cespitose, acaulescent. Leaves gray, sometimes transversely banded, slightly granular-roughened, triangular-lanceolate, gradually acute, openly concave becoming rather channeled near the end, about $5 \times 15-30$ cm., falcately ascending: spine from dull brown becoming gray, compressed-conical or acicular, nearly straight, about 3×30 mm., round-grooved below the middle or involute: prickles similarly colored, rather friable, 5-10 mm. apart, 3-4 mm. long, triangular, mostly reflexed, hardened onto the tops of low fleshy prominences between which the margin is nearly straight. Inflorescence 2-3 m. high, the top, only, paniculate: scape slender: bracts separated, ascending: branches few, short, ascending, compactly short-

branched: pedicels slender, about 5 mm. long, irregularly fasciately coherent. Flowers chrome-yellow, rather fetid, about 35 mm. long: ovary flask-shaped with a distinct neck, 15-20 mm. long, about equaling the perianth: tube 3-4 mm. deep: segments about 4×15 mm., much longer than the tube but shorter than the ovary: filaments inserted nearly in the throat, 25-30 mm. long and nearly twice as long as the segments. Capsules about 15×45 mm., scarcely stipitate but beaked: seeds about 4×5 mm.

Western border of the Colorado Desert in California at an altitude of about 3,000 feet.—*Deserti*,—of the desert, from its habitat. *Pl. 41, 42.*

Specimens examined:—CALIFORNIA. East of San Felipe (*Emory*, 1846; *Hitchcock*, 1875; *Palmer*, 1875,—the types).

Not known to extend into Lower California, but introduced here because of the close relationship borne it by the next two species.

Agave consociata Trelease.

A. deserti Orcutt, Bull. Torr. Bot. Cl. 10 : 107. 1883.—de Wildeman, Icon. Sel. Hort. Thenens. 6. *pl. 204.*

? *A. Pringlei* Simon, Cat. [1900] : 16.

Agave sp. MacDougal, Publ. Carnegie Inst. 99 : 43.

Aspect of *A. deserti*. Leaves more oblong, nearly smooth, about 6×20 -30 cm.: spine brown, becoming drab toward the base, variously acicular-conical or compressed, straight, $3-4 \times 25$ -30 mm., openly grooved below the middle or involutely closed: prickles similarly colored, rather firm, 10-25 or 30 mm. apart, 4-8 mm. long, triangular, nearly straight or variously curved, the intervening margin at most gently undulated. Inflorescence 5-7 m. high: pedicels as in *A. deserti*. Flowers 40-50 mm. long: ovary fusiform, 25-30 mm. long, considerably exceeding the perianth: tube about 5 mm. deep: segments 5×15 mm., much longer than the tube but only about half as long as the ovary: filaments inserted nearly in the throat, scarcely 30 mm. long or twice as long as the segments. Capsules light brown, 15×35 mm., scarcely stipitate, beaked: seeds?

Associated with *A. deserti* from which it differs in ovary and prickles, and extending into the Lower California desert at about the same altitude.—*Consociata*,—of the alliance, because of its relations to *A. deserti*.—*Map* (J). *Pl. 43.*

Specimens examined:—CALIFORNIA. San Felipe (*Parish*, 413, June 1882,—the type). Mountain Springs (*Parish*,

1880). Eastern base of San Jacinto Mountains (*Hall, 2117*, June 1901). LOWER CALIFORNIA. Nachoguero Valley (*Mearns, 3399*, June 3, 1894). Alamo (*Goldman, 1142*, June 11, 1905, with blackening end-spine). Cucopa Mountains (*MacDougal, 182*, 1905).

AGAVE PRINGLEI Engelmann ined. Orcutt, Bull. Torr. Bot. Cl. **10** : 107. 1883; W. Amer. Sci. **7** : 95. 1891,—name only.—Baker, Handbook Amaryllid. 182. 1888.—Ricasoli, Utilita dei Giardini d' Acclimazione. Suppl. 1: 2.—Kew List Tend. Monocot. 119.—Terracciano, Boll. Ort. Bot. Palermo. **1** : 25.—Rose in Bailey, Cyclop. **1** : 34.—Segura, El Maguey. 4 ed. 96.—? Braun, Pflanzer. **2** : 226.—? Müller, Bot. Zeit. Abt. I. **67** : 113, 135.

Aspect of *A. deserti*. Leaves triangular-oblong, essentially smooth, about 5×15 –40 cm.: spine drab with glossy brown apex, acicular, nearly straight, $3\frac{1}{2} \times 25$ –35 mm., openly grooved below the middle or involute; prickles similarly colored, more or less firm, 15–25 mm. apart, 3–5 mm. long, triangular, rather straight or upcurved, somewhat lenticularly hardened into the nearly straight margin. Inflorescence as in *A. deserti*, with rather more divided branches, about 2 m. high. Flowers 40–50 mm. long: ovary fusiform, in age developing a rather long neck, 25–30 mm. long, considerably exceeding the perianth; tube 4–6 mm. deep: segments about 4×15 mm., much longer than the tube and fully half as long as the ovary: filaments inserted nearly in the throat, 30–35 mm. long, rather more than twice as long as the segments. Capsules beaked, becoming grayish straw-color, otherwise strikingly diverse: narrow (12×45 mm.), evidently stipitate and slender-pediceled; or short (15×30 –35 mm.), little stipitate and stouter-pediceled: seeds $3\frac{1}{2} \times 5$ –7 mm.

Mountains of Lower California, at an altitude of about 6,000 feet.—*Pringlei*,—C. G. Pringle,—the most extensive and best collector of Mexican plants.—*Map (K). Pl. 44*.

Specimens examined:—Central plateau (*Pringle*, April 1882,—the type of *A. Pringlei* Engelm. in herb.). Central mountains (*Orcutt*, Oct. 7, 1882, distributed without number by Pringle,—the type of *A. Pringlei* as described by Baker). Pinery, Hanson's ranch (*Orcutt*, 943, July 26, 1883). Pinône forest (*Orcutt*, Aug. 1, 1883).

Agave cerulata Trelease.

? *Agave* sp. Brandegee, Proc. Cal. Acad. ii. 2 : 208.
 ? *A. deserti* Purpus, Monatsschr. f. Kakteenk. 9 : 37. 1899; *Cactus* Journ. 2 : 54.—Weber, Bull Mus. Hist. Nat. 8 : 223.
 ? *A. Diguettii* Simon, Cat. [1900] : 15, not Weber!—Name only.

Habit? Leaves grayish or glaucous, slightly granular-roughened, linear- or oblong-triangular, gradually acute, deeply concave, becoming channeled near the end, $2-4 \times$ about 30 cm.: spine acicular, nearly straight, finally gray-brown, $2 \times 25-30$ mm., slit-grooved below, decurrent for scarcely its own length: prickles dull brown, graying, 10 or 15-25 mm. apart, scarcely 3 mm. long, mammaeform or triangular, friable and easily detached, on fleshy prominences between which the margin is rather straight. Inflorescence 3-4 m. high, slender, paniculate, with the ultimate branches subracemosely fasciate, at first blue-waxen, much as in *Negundo*: pedicels thick, free for scarcely 5 mm. Flowers yellow, 35 mm. long: ovary stout, $5 \times 15-20$ mm., oblong, rather exceeding the perianth: tube cup-shaped, about 3 mm. deep: segments oblong, $4 \times 12-15$ mm., much exceeding the tube and approximating the ovary in length: filaments inserted nearly in the throat, about 25 mm. long, and little more than twice as long as the segments. Capsules pyriform-oblong, thick-walled, glaucous, 20×55 mm., scarcely stipitate and little beaked: seeds?

Central Lower California, south from Calmalli.—*Cerulata*,—touched with wax, from its glaucous inflorescence.—*Map* (L.) *Pl. 45-47*.

Specimens examined:—Calmalli (*Miller and Rose*, 4013, Oct. 30, 1897; *Nelson and Goldman*, 7180, Sept. 29, 1905, —the type). San Benito (*Brandegee*, Apr. 10, 1889).

Agave carminis Trelease

Habit? Leaves smooth, gray-green, triangular-oblong, acute, thick, becoming channeled near the end, about $5 \times 30-40$ cm.: spine slightly glossy, from light brown becoming rather gray, acicular, gently a little upcurved, 2×35 mm., slit-grooved to the middle, very long-decurrent; prickles similarly colored, firm, 20-30 mm. apart, about 5 mm. long, narrowly triangular, variously and irregularly curved, slightly lunately widened onto the tops of low fleshy prominences between which the margin is nearly straight. Inflorescence paniculate with slender scape and short ascending nearly simple branches at the ends of which the very short but rather thick pedicels are compactly clustered. Flowers and fruit?

Island region of east-central Lower California.—*Carminis*,—of Carmen Island, where it occurs.—*Map* (M). *Pl. 48, 49*.

Specimens examined:—Carmen Island (*Rose*, 16639, April 3, 1911,—the type).

AGAVE SOBRIA Brandegee, Proc. Cal. Acad. ii. 2: 207. 1889: Gard. & For. 3: 106.

Habit? Acaulescent. Leaves smooth, glaucous, lanceolate, 60 cm. long: spine?—said not to be decurrent: prickles chestnut, rather dull and glaucous, usually 20–30 mm. apart, 8–10 mm. long, narrowly triangular, variously curved, sometimes a little lunately widened onto the tops of low fleshy prominences between which the margin is straight or concave. Inflorescence not over 5 m. high, the upper third paniculate. Flowers light greenish yellow, 45–50 mm. long: ovary 20–25 mm. long, fusiform-oblong: tube cup-shaped, 5 mm. deep: segments oblong, 4×20 –22 mm., much exceeding the tube and about as long as the ovary; filaments inserted nearly in the throat, 40–45 mm. long, about twice as long as the segments. Capsules brown, broadly oblong, 20–55 mm., scarcely stipitate or beaked: seeds?

East-central Lower California, north from Comondu.—*Sobria*,—not given to alcohol, it being reputed of no use for the preparation of mezcal.—*Map* (N). *Pl. 50, 51.*

Specimens examined:—Comondu mesas (Brandegee, 2, Mar. 23, 1889,—the type). San Esteban (?Brandegee, Apr. 17, 1889). Cardon Grande (?Brandegee, Apr. 22, 1889).—The last two numbers, without leaf-material, have flowers and capsules of this rather than the associated *A. cerulata*.

Agave affinis Trelease.

?*Agave* sp. Brandegee, Proc. Cal. Acad. ii. 2: 208. 1889.

Habit? Leaves scabrous, glaucous, gray-green, triangular-oblong, becoming channeled near the end, about 5×50 cm.: spine dull, light brown to ashen or nearly white, compressed-acicicular, gently somewhat undulate, $2-3 \times 30$ –50 mm., slit-grooved toward the base, long-decurrent; prickles similarly colored, 10–20, 30 or even 40 mm. apart, 5–7 mm. long, narrowly triangular, nearly straight, somewhat lunately widened onto the tops of fleshy prominences between which the margin is more or less concave. Inflorescence paniculate with short branches: pedicels thick, less than 5 mm. long. Flowers? Capsules light brown, oblong, $15-20 \times 40$ –50 mm., stipitate and beaked: seeds?

Eastern Lower California.—*Affinis*,—related to, because of its resemblances to *A. sobria*, from which, so far as known, it differs mainly in its rough leaves, lighter brown prickles

and more beaked and stipitate capsules.—*Map* (O). *Pl. 52, 53.*

Specimens examined:—Head of Concepcion Bay (*Rose, 16676, Apr. 5, 1911.*—the type).

Possibly the nondescript *A. scaberrima* and the erroneously named *A. Diguettii* belong here rather than under *A. deserti*.

Agave Brandegeei Trelease.

? *Agave* sp. Brandegee, Proc. Cal. Acad. ii. 3 : 227, no. 728.

Habit? Leaves smooth, grayish yellow-green, lanceolate, gradually acute, about 10×60 cm.: spine stoutly conical-awl-shaped, recurving, glossy, red-brown, 4×20 mm., involutely grooved to above the middle, decurrent for about its own length: prickles chestnut, firm and rather glossy, about 10 mm. apart, 2 mm. long, gently upcurved or occasionally hooked, obliquely deltoid, their bases 4 mm. wide, the intervening margin straight. Inflorescence paniculate; pedicels scarcely 5 mm. long. Flowers apparently yellow, 45 mm. long: ovary 5×25 –30 mm., fusiform; segments 3×12 –15 mm., much longer than the tube but less than half as long as the ovary: filaments inserted nearly in the throat, 30–40 mm. long, two or three times as long as the segments. **Fruit?**

Southern Lower California.—*Brandegeei*,—T. S. Brandegee, an extensive collector and excellent student of many plants of widely separated parts of arid North America.—*Map* (P). *Pl. 54.*

Specimens examined:—Cape region mountains (*Brandegee, Sept. 20, 1899,*—the type). San Jose del Cabo (*Purpus, Jan.-March. 1901*).—Both collections are intermixed with flowers of *A. promontorii*.

AGAVE MARGARITAE Brandegee, Proc. Cal. Acad. ii. 2 : 206. *pl. 10. 1889.*—Franceschi, Gard. & For. 8 : 228.—Kew Hand List Tend. Monocot. 115.—Rose in Bailey, Cyclop. 1 : 36.

Cespitose, acaulescent. Leaves green, dull, glaucous and transversely banded, essentially smooth, nearly round to obovate-oblanceolate, acuminate, openly concave, channeled toward the end, 6 – 10×12 – 20 cm., rather openly spreading: spine from chestnut becoming dull gray, acicular, slightly wavy, 3×25 mm., round-grooved below the middle, decurrent for its own length or less: prickles similarly colored, about 10 mm. apart, 6–8 mm. long, narrowly triangular, pre-

vailingly down-curved below and upcurved above, little widened onto the tops of low fleshy prominences between which the margin is somewhat concave. Inflorescence 3-4 m. high, the upper third or less paniculate with short outcurved-ascending little-divided branches: pedicels 2-3 mm. long. Flowers light yellow, 45-50 mm. long: ovary 25-30 mm. long, fusiform: tube deep for the group, about 10 mm.: segments attenuate, short, 5×15 mm., one-half longer than the tube and about half as long as the ovary: filaments inserted nearly in the throat of the tube, scarcely 25 mm. long and less than twice as long as the segments. Capsules brown, oblong or pyriform, $15-20 \times 30-50$ mm., not stipitate but somewhat beaked: "seeds 3-4 mm. in diameter, smooth."

Islands of southwestern Lower California.—*Margaritae*,—of Santa Margarita Island, where it is said to occur.—*Map (Q)*. *Pl. 55, 56*.

Specimens examined:—Magdalena Island (*Brandegee*, Jan. 14, 1889,—the type; *Rose*, 16316, Mar. 21, 1911).

Agave connochaetodon Trelease.

Cespitose, acaulescent. Leaves pale green, somewhat glaucous, dull, essentially smooth, oblanceolate, acuminate, openly concave, channeled toward the end, 6×25 cm.: spine from dull red becoming drab and then ashen, compressed-acicular, flexuous, $3-4 \times 40-50$ mm., round-grooved below the middle, decurrent for about its length: prickles dull red or brown, $15-20$ mm. apart, $10-15$ mm. long, elongated-triangular, prevailingly down-curved below, upcurved above, often with flexed base, little widened on the tops of rather large fleshy prominences between which the margin is deeply concave above. Inflorescence 3 m. high, slender, with few horizontal compound branches: pedicels about 3 mm. long. Flowers? Capsules dark, oblong, $15 \times 35-40$ mm., not stipitate, beaked: seeds?

Southwestern Lower California.—*Connochaetodon*,—gnuthoothed, because of the peculiar curvature of the prickles.—*Map (R)*. *Pl. 57*.

Specimens examined:—Sta. Maria Bay (*Rose*, 16261, Mar. 18, 1911,—the type).

Santa Margarita and Magdalena Islands are scarcely detached portions of the mainland, the former cut off by a narrow channel scarcely reaching a depth of fifty feet, and the latter by wider shoals covered by scarcely one-fifth this depth of water. There is no reason to suppose that an agave

found on one should not occur on the other or on the mainland, nor is there evident reason for specific differentiations. It is, therefore, with considerable hesitancy that, because of the very different arming of the specimens collected, a second species is recognized for these islands.

Agave Roseana Trelease.

Somewhat cespitose, acaulescent. Leaves glaucous gray-green, the neck somewhat transversely banded, smooth, broadly lanceolate, somewhat acuminate, openly concave, as much as 15×50 cm., stiffly somewhat spreading: spine from glaucous purplish chestnut becoming dull ashen, compressed-acicular, tortuous, $3-4 \times 50-70$ mm., round-grooved to or beyond the middle, decurrent: prickles from glaucous brown soon becoming pinkish drab or creamy, about 30 mm. apart, 10-25 mm. long and sometimes 10 mm. wide, mostly broadly triangular, variously and very irregularly curved, hooked or doubly flexed, usually rather abruptly or lunately dilated, sometimes to a width of 15 mm., onto the tops of large fleshy prominences between which the margin is either straight or very concave. Inflorescence 2-3 m. high, narrowly paniculate at top: scape slender: branches very compactly short-branched at the end: pedicels slender, varying from 2-7 mm. in length. Flowers 40-50 mm. long: ovary 25-30 mm. long, fusiform-oblong: tube saucer-shaped, 2-3 mm. deep: segments $3 \times 12-15$ mm., very much longer than the tube and half as long as the ovary: filaments inserted nearly in the throat, 30-35 mm. long, more than twice as long as the segments.

Southeastern Lower California.—*Roseana*,—J. N. Rose, a critical student and expert collector of many groups of North American plants, whose field work is a model for those desirous of advancing knowledge of such difficult plants as the present genus offers.—*Map* (S). *Pl. 58-60.*

Specimens examined:—La Paz (*Brandegee*, Apr. 14, 1892). On peninsula opposite Pichilinque Island (*Rose*, 16524, Mar. 28, 1911). Espiritu Santo (*Rose*, 16854, Apr. 18, 1911,—the type).

A remarkable species, alike in its very slender long tortuous spine—sometimes long-continued by the similarly wavy horny-margined leaf-tip, and its very large flat marginal teeth,—in both respects recalling some of the marginatae Littaeas.

Agave avellanidens Trelease.

Agave sp. Brandegee, Proc. Cal. Acad. ii. 2 : 208. 1889.

Habit? Leaves smooth, broadly lanceolate, long-acuminate, rather channeled toward the end, $11 \times$ upwards of 60? cm.: spine drab, slightly polished at the end only, narrowly conical, wavy, 5×50 mm., round-grooved to beyond the middle, long-decurrent: prickles similarly colored, glossy, 25-50 mm. apart or with a smaller one intercalated, as much as 10 mm. long and 5 mm. wide, broadly triangular, variouly and unequally gently curved, somewhat lunately dilated to about 10 mm. onto the tops of broad very low elevations of the little repand margin. Inflorescence paniculate: pedicels 5-10 or 12 mm. long, rather slender. Flowers 60 mm. long: ovary 35 mm. long, fusiform: tube 5 mm. deep: segments 4×20 mm., very much longer than the tube and more than half as long as the ovary: filaments inserted in the throat of the tube, 40 mm. long and twice as long as the segments. Capsules dark brown, broadly oblong, 20×35 mm., not stipitate and scarcely beaked: seeds?

East-central Lower California.—*Avellanidens*,—filbert-toothed, from the nut-color of its prickles.—Map (T). Pl. 61, 62.

Specimens examined: Paraiso (Brandegee, 6, May 1, 1889,—the type).

Agave subsimplex Trelease.

Habit? Leaves very glaucous, somewhat transversely banded below, nearly smooth, broadly oblong- or elliptical-lanceolate, slightly acuminate, about 5×15 cm.: spine slightly curved, shortly acicular, dull ashen-gray, 3×20 mm., round-grooved below the middle, little-decurrent: prickles from blackish purple or through yellow and scarlet becoming similarly colored, 10-20 mm. apart, 5-10 mm. long, narrowly triangular, mostly upcurved above and recurved below, little widened into the tops of rather high fleshy prominences between which the margin is rather straight. Inflorescence slender, narrowly paniculate, the lower branches short-branched, the upper nearly simple: pedicels extremely short. Flowers? Capsules brown, apparently varying greatly and almost inconceivably: short (15×30 mm.) and rather obscurely stipitate and beaked; or much larger (20×65 mm.) with prominent beak and long stipitate contraction: seeds about 4×5 mm.

Gulf Islands of Sonora.—*Subsimplex*,—nearly unbranched, from its inflorescence.—Map (U). Pl. 63, 64.

Specimens examined:—Seal Island, just off Tiburon Island- (Rose, 16811, Apr. 13, 1911,—the type).

The distributional remarks under *A. dentiens* pertain also to this species.

Agave Nelsoni Trelease.

A. Shawii Nelson, Nat. Geogr. Mag. 22:449, 451. *ff.* 1911.

Cespitose, acaulescent. Leaves smooth, glaucous, lance-oblong or ovate-oblong, little acuminate, openly concave, about $7 \times 18-35$ cm., stiffly erect-spreading: spine straight, half-conical, dull grayish or blackish, 5×30 mm., very openly grooved to the upper third, decurrent for about its own length: prickles fragile and easily detachable, fading from dull brown, 10-20 mm. apart, about 5 mm. long, broadly triangular, lightly curved, especially upwards. Inflorescence 3-8 m. high, paniculate only at the top: scape slender: bracts rather distant, appressed: branches few, short, ascending or upcurved, tripartite: pedicels about 5 mm. long. Flowers light yellow, cup-shaped, 40-50 mm. long: ovary 20-30 mm. long, fusiform; tube extremely short, 2-3 mm. deep; segments rather elliptical, $4-7 \times 15-17$ mm., decidedly shorter than the ovary: filaments inserted on the outer part of the nearly flat floor of the tube, 30-35 mm. long and twice as long as the segments. Fruit?

North-central Lower California, at an altitude of 1400-1800 feet.—*Nelsoni*, E. W. Nelson, one of the most expert field students of the geographic distribution of North American animals and plants.—*Map (V).* *Pl. 65-67.*

Specimens examined:—San Fernando (*Nelson and Goldman*, 7111, Sept. 4, 1905,—the type). Onyx (*Nelson and Goldman*, 7117, Sept. 7, 1905,—with more elongated leaves and larger flowers, on which, perhaps, it is differentiable).

AGAVE DATYLIO Simon, Cat. [1900]: 15,—name only.—Weber. Bull. Mus. Hist. Nat. 8: 223. 1902.

Agave sp. Brandegee, Proc. Cal. Acad. ii. 3:174, 227. nos. 581, 729.

Cespitose, acaulescent. Leaves yellowish gray-green, smooth, oblong-lanceolate, channeled above, $3-4 \times 30-75$ cm., fleshy, rigid: spine nearly straight, stoutly triquetrously conical, from glossy purplish brown becoming blackish or gray, $4-6 \times 20-30$ mm., little decurrent, very shallowly and openly grooved near the base: prickles from glossy chestnut becoming dull grayish brown, 20-30 or even 50 mm. apart, 3-5 mm. long, triangular and mostly recurved from heavy or lenticular bases or the narrowed cusps lacking. Inflorescence 4-5 m. high, lightly glaucous, the slender scape branches moderately short-

branched at end: pedicels under 5 mm. long. Flowers 45–55 mm. long: ovary about 22 mm. long, glaucous, stoutly fusiform: tube 8–10 or even 12 mm. deep: segments 3–4 \times 12–15 or 20 mm., considerably exceeding the tube and more than half as long as the ovary: filaments inserted about the middle of the tube, 35–45 mm. long and more than twice as long as the segments, with typically very long (30 mm.) anthers. Capsules brown, broadly oblong or pyriform, about 20 \times 35–40 mm., stipitate and shortly beaked: seeds 6 \times 7 mm.

Southern Lower California.—*Datylis*,—said by the author of the species to be its local vernacular name.—*Map* (W). *Pl. 68, 69.*

Specimens examined:—La Paz—the type locality (*Rose, 1302*, June 14, 1897; *16540*, Mar. 29, 1911; *Brandegee, 1899*). San Pedro (*Brandegee, 581*, Oct. 29, 1891).

Agave vexans Trelease.

Habit? Leaves grayish green, smooth, linear-triangular, very gradually acute, openly concave becoming channeled toward the end, 2 \times 20–45 cm., stiff and straight: spine dull gray-brown, triquetrously conical, essentially straight, 3–5 \times 25–35 mm., grooved in the lower part: prickles fading from dull dingy brown, rather easily detachable, 15–20 or 30 mm. apart, 3–4 mm. long, heavily triangular, or with somewhat slender cusps. Inflorescence 1.5–2 m. high, lightly glaucous, the slender scape with slender outcurved-ascending branches short-branched at the end: pedicels scarcely 5 mm. long. Flowers apparently greenish, about 40 mm. long: ovary glaucous, 20–25 mm. long, fusiform or flask-shaped: tube about 8 mm. deep: segments 3–4 \times 12–15 mm., about twice as long as the tube and more than half as long as the ovary: filaments inserted about the middle of the tube, scarcely 25 mm. long or twice as long as the segments, with rather short (15 mm.) anthers. Capsules light gray-brown, broadly oblong, 20 \times 35–45 mm., shortly stipitate, conspicuously beaked: seeds 5 \times 6 mm.

East-central Lower California.—*Vexans*,—annoying, because of its occurrence apart from its close relative, *A. Datylis*. *Map* (X). *Pl. 70-72.*

Specimens examined:—Purisima? (*Brandegee, 1889*). Paso de los Dolores to Lake Ramon (*Brandegee, April 4, 1889*). Near El Potrero, below Mulege (*Nelson and Goldman, 7237*, Oct. 31, 1905,—the type).

EXPLANATION OF PLATES.

All of the illustrations are from herbarium specimens unless otherwise noted; herbarium sheets are uniformly reduced to one-third natural size; details are of natural size. For the habit figures I am under great obligation to the gentlemen whose names are mentioned in connection with the explanation of them. On the distribution map, the localities at which collections have been made are marked by circles accompanied by indicative letters that are referred to in the text.

Plate 18.—*Agave* in Lower California. The distribution of the groups evident from accompanying legend.

Plate 19.—*Agave Shawii*. A characteristic group of plants near San Diego. Reproduced from Rept. Mo. Bot. Garden. 7. pl. 44.

Plate 20.—*Agave Shawii*. 1, Upper portion of leaf of type, in the Garden herbarium. 2, An opened flower from a plant from the type locality that bloomed in the Missouri Botanical Garden in 1877.

Plate 21.—*Agave Shawii*. Capsules and seeds of type.

Plate 22.—*Agave Orcuttiana*. Leaf and opened flower of type, in the Garden herbarium.

Plate 23.—*Agave sebastiana*. Habit of growth on Cedros Island. Enlarged from a negative made by Dr. C. H. Townsend in 1911. About $\frac{1}{40}$ natural size.

Plate 24.—*Agave sebastiana*. A co-type (Cedros Island, Greene, May 1, 1885), in the herbarium of the University of California.

Plate 25.—*Agave sebastiana*. Foliage armed as in *A. Shawii*. (Cedros Island, Rose, 16122).

Plate 26.—*Agave sebastiana*. 1, Margin, opened flower and capsule (San Benito Island, Rose, 16041). 2, Spine and capsule (Cedros Island, Rose, 16122).

Plate 27.—*Agave pachyacantha*. Spines and margins of the type.

Plate 28.—*Agave pachyacantha*. Flowers, leaf margin and capsules (Colnett, Brandegee, May 1893).

Plate 29.—*Agave Goldmaniana*. Habit of growth. Enlarged from a photograph by E. A. Goldman; published by permission of the Bureau of Biological Survey of the United States Department of Agriculture. About $\frac{1}{40}$ natural size.

Plate 30.—*Agave Goldmaniana*. Type (Yubai, Nelson & Goldman, 7151), in the National Herbarium.

Plate 31.—*Agave Goldmaniana*. Details, from the type sheet.

Plate 32.—*Agave aurea*. Type (Purisima, Brandegee, Feb. 13, 1889), in the herbarium of the University of California.

Plate 33.—*Agave aurea*. Details from the type sheet.

Plate 34.—*Agave aurea*. Bract-tip, spine, prickles, flower and capsule from Comondu (Nelson & Goldman, 7274), in the National Herbarium.

Plate 35.—*Agave promontorii*. Habit of growth. Enlarged from a photograph by E. A. Goldman: published by permission of the Bureau of Biological Survey of the United States Department of Agriculture. About $\frac{1}{40}$ natural size.

Plate 36.—*Agave promontorii*. Type (Sierra la Laguna, Nelson & Goldman, 7437), in the National Herbarium.

Plate 37.—*Agave promontorii*. 1, Pedicels and flowers, one opened (San Jose del Cabo, Purpus, 1901). 2, Spine, prickles and capsules (Cabo San Lucas, Rose, 16326).

Plate 38.—*Agave dentiens*. Habit of growth on San Esteban Island. Enlarged from a negative made by Dr. Paul Bartsch in 1911. About $\frac{1}{30}$ natural size.

Plate 39.—*Agave dentiens*. Type (San Esteban, Rose, 16819), in the National Herbarium.

Plate 40.—*Agave dentiens*. Details, from the type sheet.

Plate 41.—*Agave deserti*. Habit of growth near San Felipe in the Colorado desert of southern California. Enlarged from an old stereoscopic print by Parker. About $\frac{1}{15}$ natural size.

Plate 42.—*Agave deserti*. Leaf and flowers of type material (the upper flower collected by Emory in 1846), in the Garden herbarium.

Plate 43.—*Agave consociata*. Spine, prickles, pedicels and flowers, from the eastern base of the San Jacinto Mountains (Hall, 2117).

Plate 44.—*Agave Pringlei*. 1, Spines, prickles and rough-dried flowers, one opened, of the type exsiccata. 2, Capsules and seeds of the two forms of fruit collected by Orcutt with the preceding material, but apparently distributed in only a few of the sets.

Plate 45.—*Agave cerulata*. Type (Calmalli, Nelson & Goldman, 7180), in the National Herbarium.

Plate 46.—*Agave cerulata*. Details, from the type sheet.

Plate 47.—*Agave cerulata*. Leaf-tip and part of fruiting inflorescence from San Benito (Brandegee, April 10, 1889), in the herbarium of the University of California.

Plate 48.—*Agave carminis*. Type (Carmen Island, Rose, 16639), in the National Herbarium.

Plate 49.—*Agave carminis*. Details, from the type sheet.

Plate 50.—*Agave sobria*. Type (Comondu, Brandegee, 2, March 23, 1889), in the herbarium of the University of California.

Plate 51.—*Agave sobria*. Details, from the type sheet.

Plate 52.—*Agave affinis*. Type (Head of Concepcion Bay, Rose, 16676), in the National Herbarium.

Plate 53.—*Agave affinis*. Details, from the type sheet.

Plate 54.—*Agave Brandegeei*. 1, Spine and basal prickles of the type (Cape region mountains, *Brandegee*, Sept. 20, 1899), in the Garden herbarium. 2, Prickles and flowers of the same collection in the herbarium of the University of California.

Plate 55.—*Agave margaritae*. Type (Magdalena Island, *Brandegee*, Jan. 14, 1889), in the University of California herbarium.

Plate 56.—*Agave margaritae*. 1, Flowers, from the type sheet. 2, End of branch of fruiting panicle (Magdalena Island, *Rose*, 16316), in the National Herbarium.

Plate 57.—*Agave connochaetodon*. Spines, prickles and fruit of the type (Sta. Maria Bay, *Rose*, 16261), in the National Herbarium.

Plate 58.—*Agave Roseana*. Type (Espiritu Santo, *Rose*, 16854), in the National Herbarium.

Plate 59.—*Agave Roseana*. Details, from the type sheet.

Plate 60.—*Agave Roseana*. Leaf and flower details (La Paz, *Brandegee*, Apr. 14, 1892), from material in the herbarium of the University of California.

Plate 61.—*Agave avellanidens*. Type (Paraiso, *Brandegee*, 6, May 1, 1889), in the herbarium of the University of California.

Plate 62.—*Agave avellanidens*. Details, from the type sheet.

Plate 63.—*Agave subsimplex*. Type (Seal Island, *Rose*, 16811), in the National Herbarium.

Plate 64.—*Agave subsimplex*. Details, from the type sheet.

Plate 65.—*Agave Nelsoni*. Habit of growth in a characteristic *Idria* association. Enlarged from a photograph by E. A. Goldman: published by permission of the Bureau of Biological Survey of the United States Department of Agriculture. About $\frac{1}{30}$ natural size.

Plate 66.—*Agave Nelsoni*. Type (San Fernando, *Nelson & Goldman*, 7111), in the National Herbarium.

Plate 67.—*Agave Nelsoni*. 1, Details, from the type sheet. 2, Leaf-tip and flowers of the more oblong-leaved larger-flowered form (Onyx, *Nelson & Goldman*, 7117), in the National Herbarium.

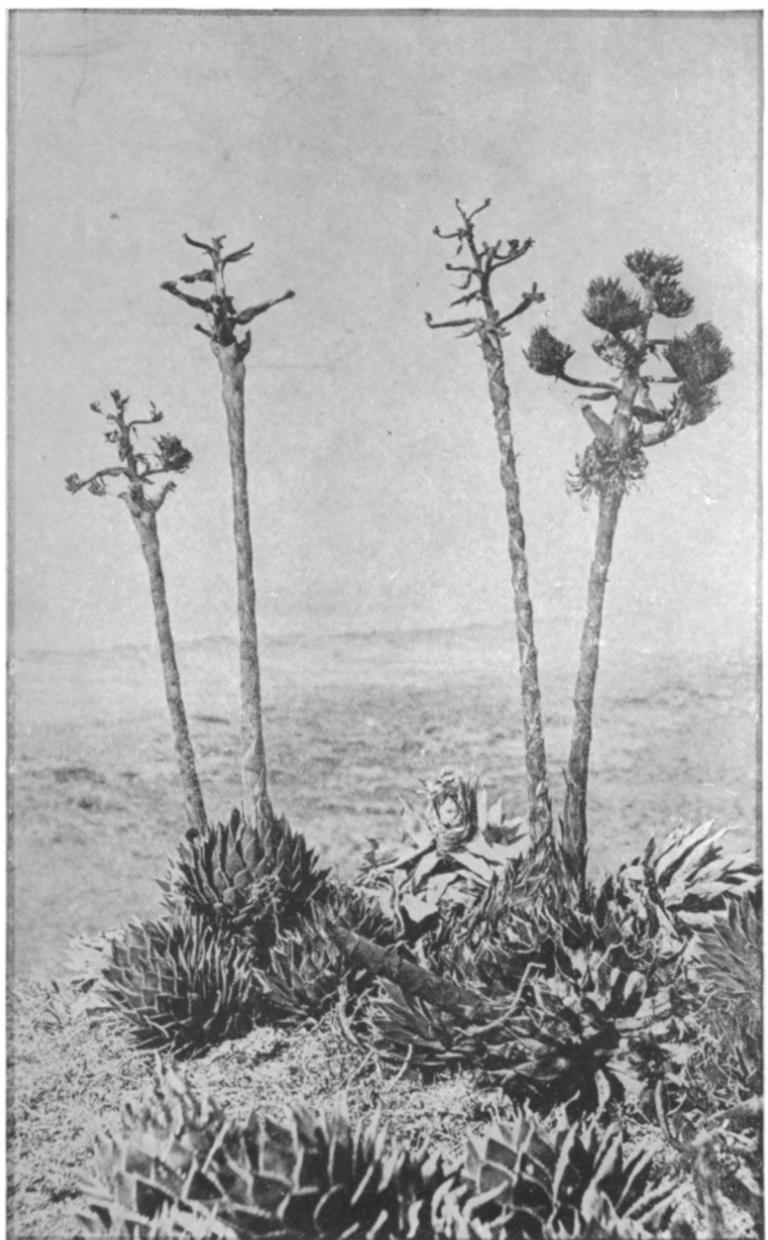
Plate 68.—*Agave Datyllo*. 1, Leaves (La Paz, *Rose*, 16540), in the National Herbarium, — $\times \frac{1}{4}$. 2, Details, from the same sheet.

Plate 69.—*Agave Datyllo*. 1, Pedicels and flowers (La Paz, *Brandegee*, 1899). 2, Flowers and, apparently undeveloped, capsules (San Pedro, *Brandegee*, 581). Both from the herbarium of the University of California.

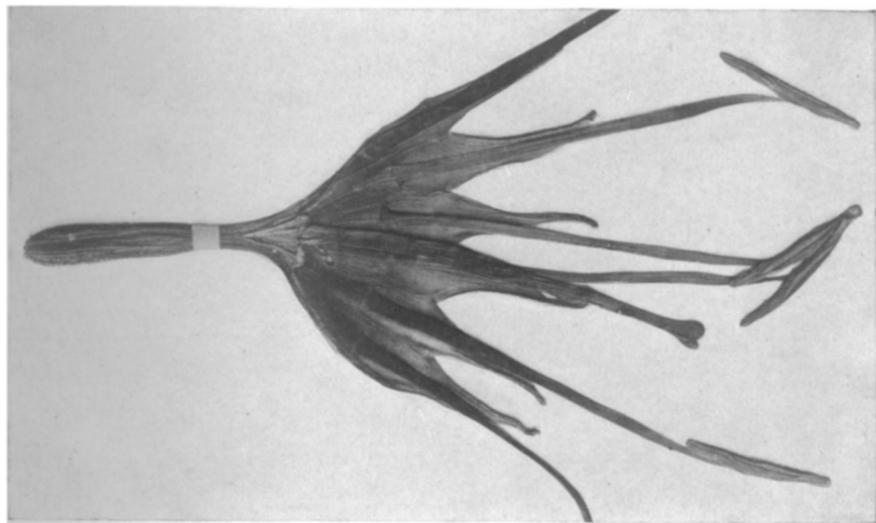
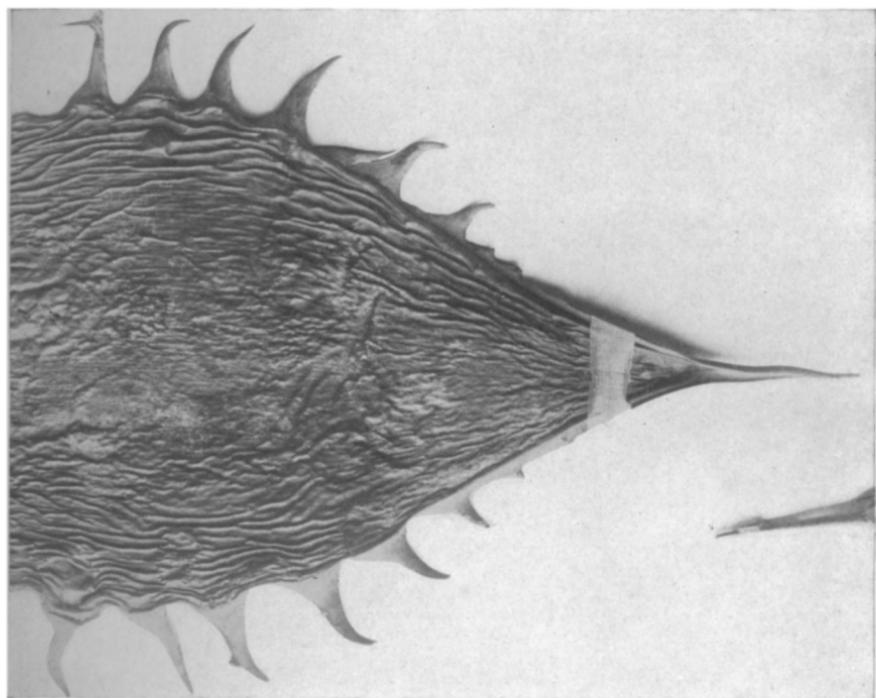
Plate 70.—*Agave vexans*. Brandegee collections of 1889, in the University of California herbarium.

Plate 71.—*Agave vexans*. Details, from the preceding.

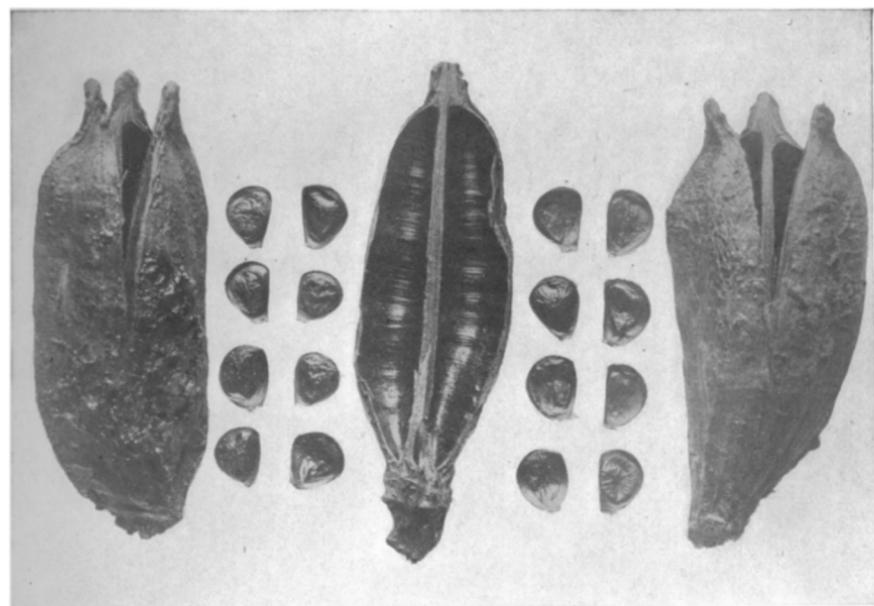
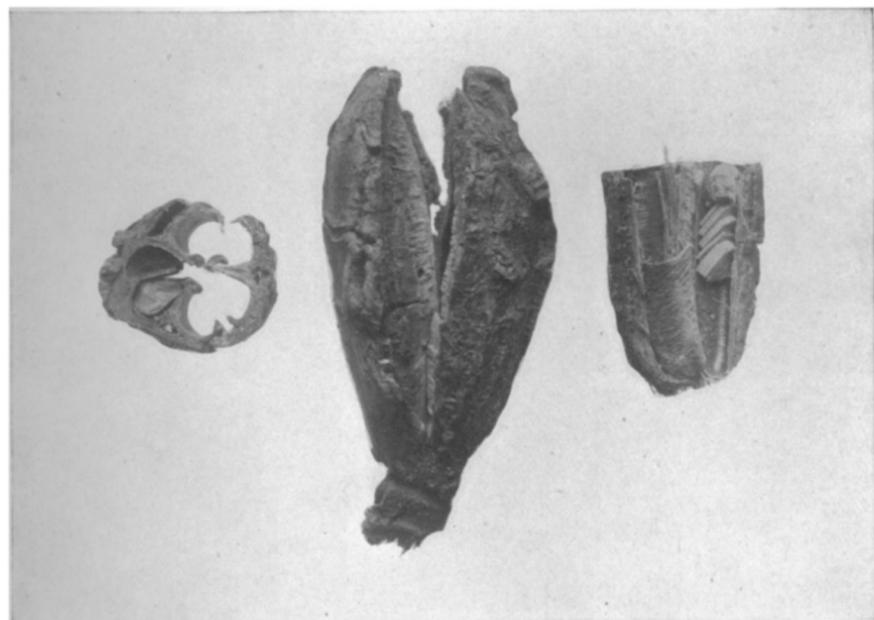
Plate 72.—*Agave vexans*. Details, from the type sheet, in the National Herbarium.



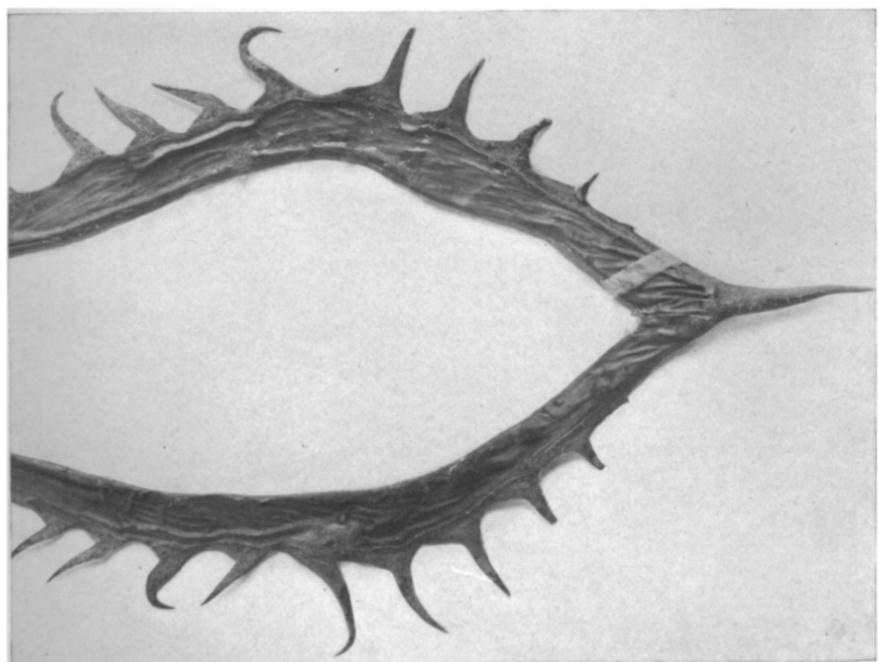
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AGAVE SHAWII.



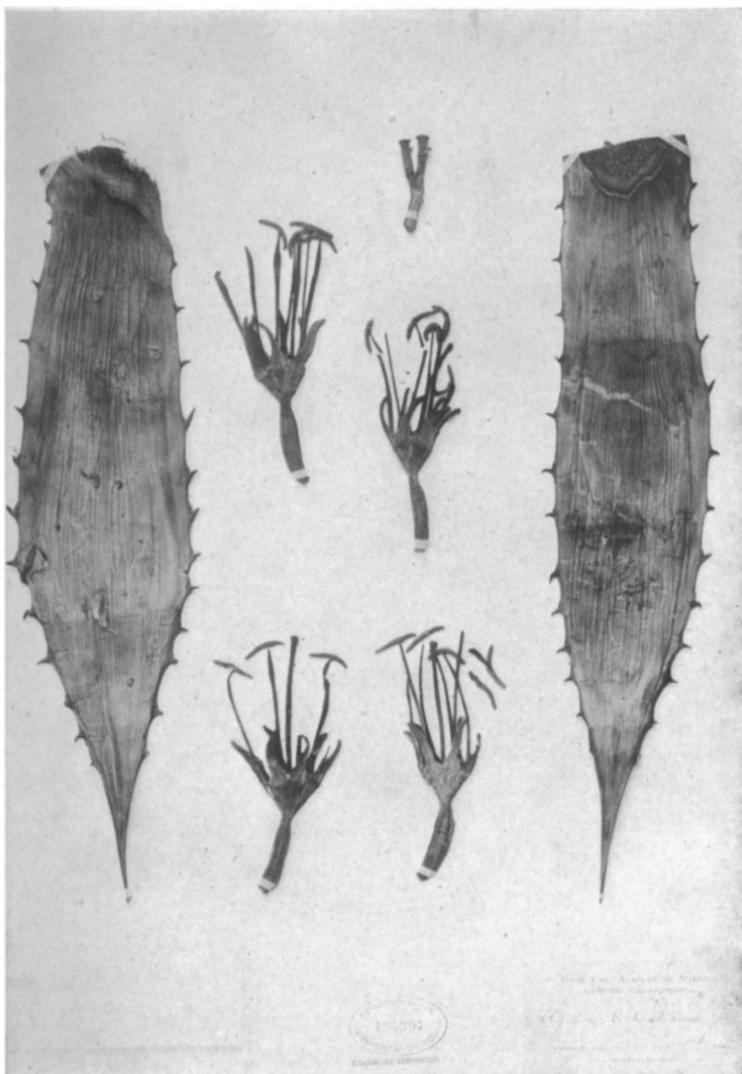
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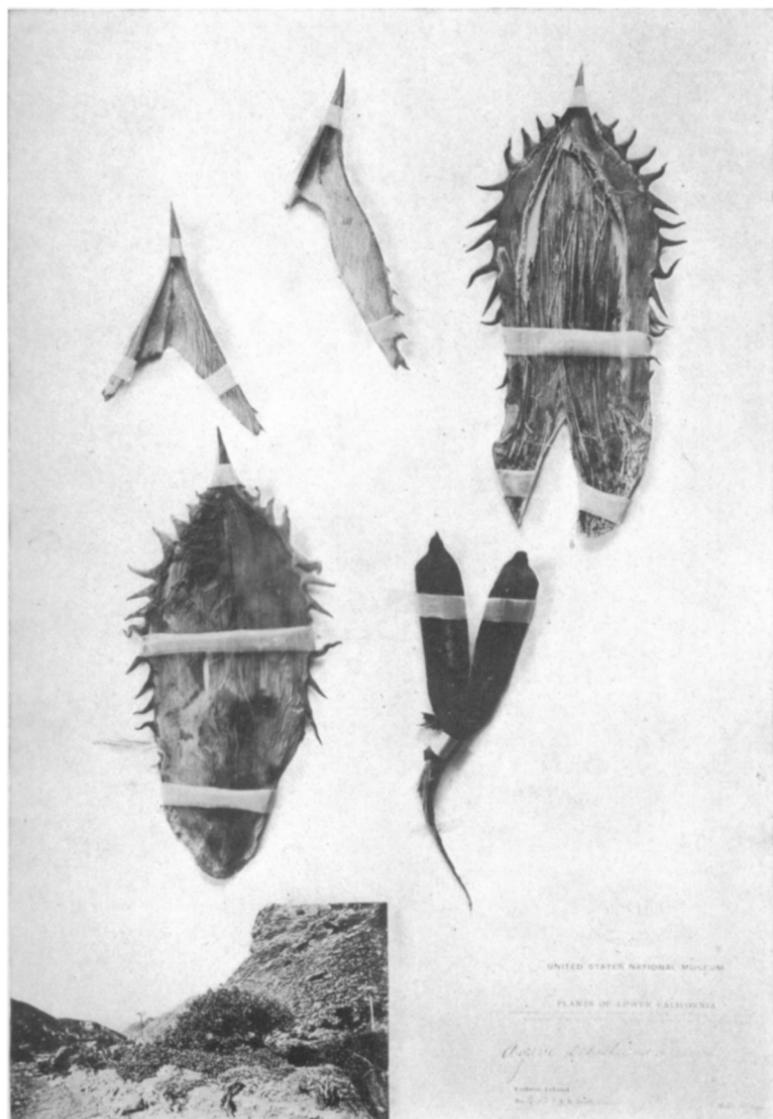
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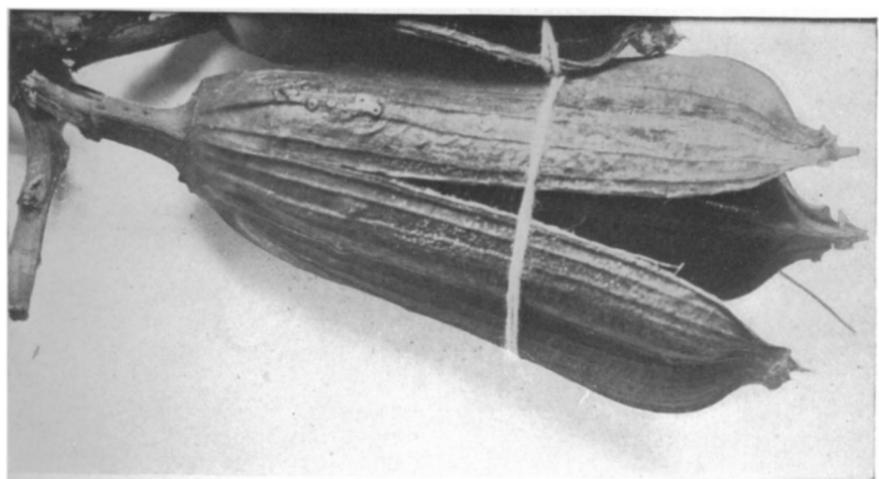
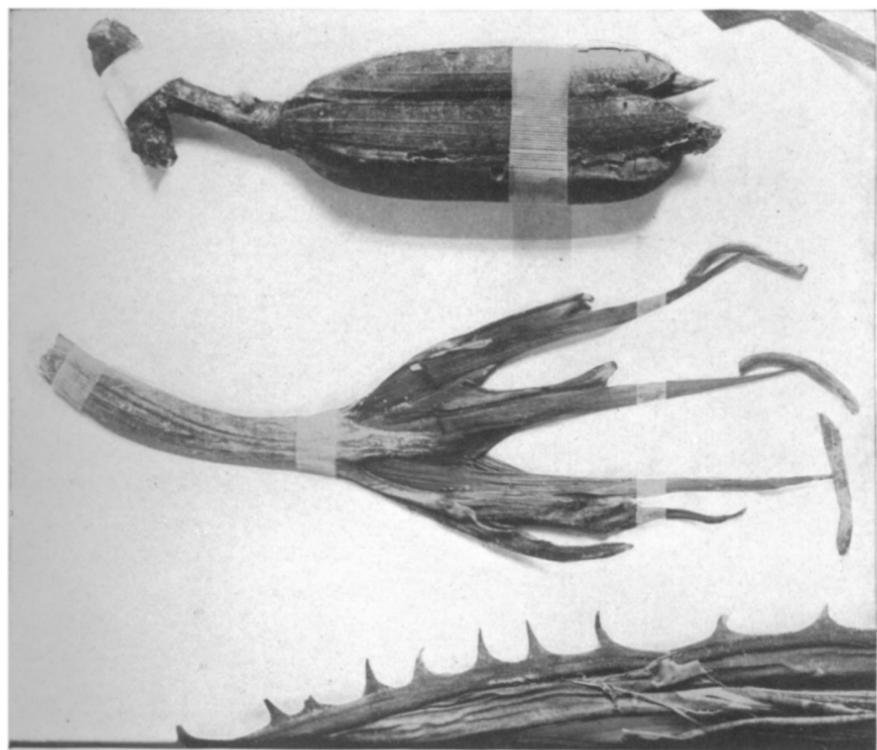
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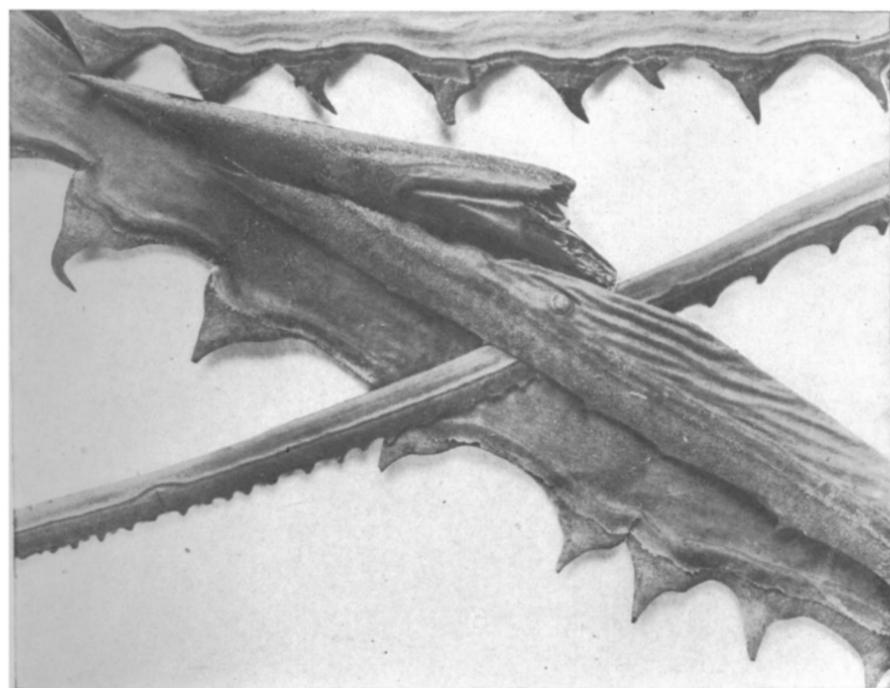
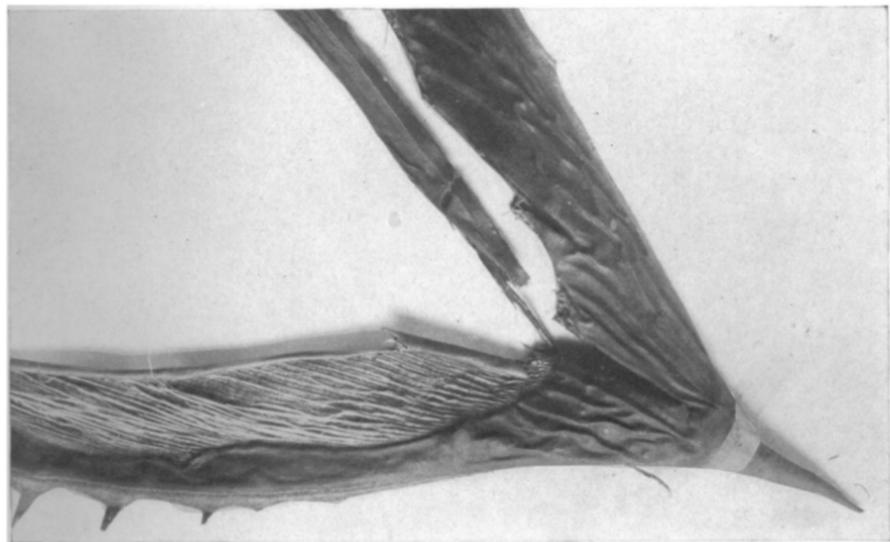
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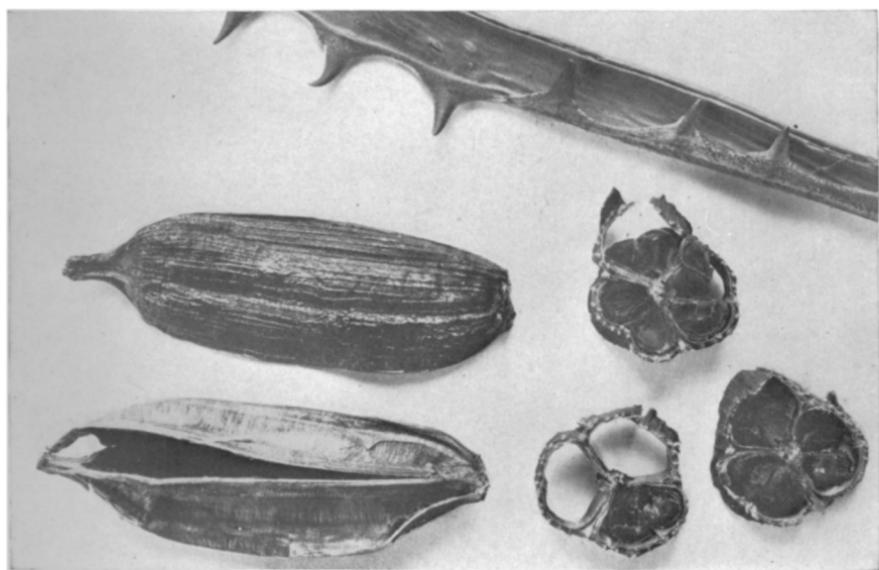
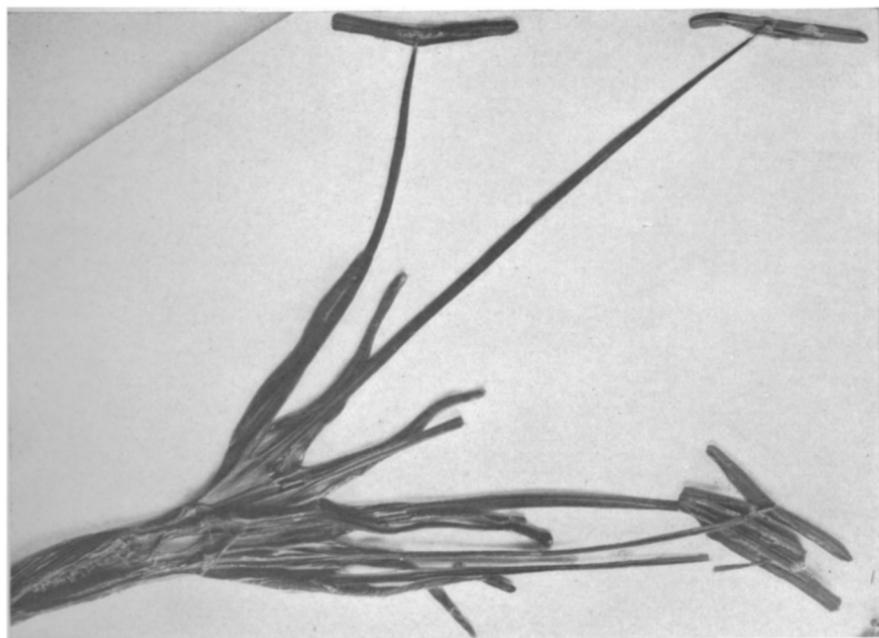
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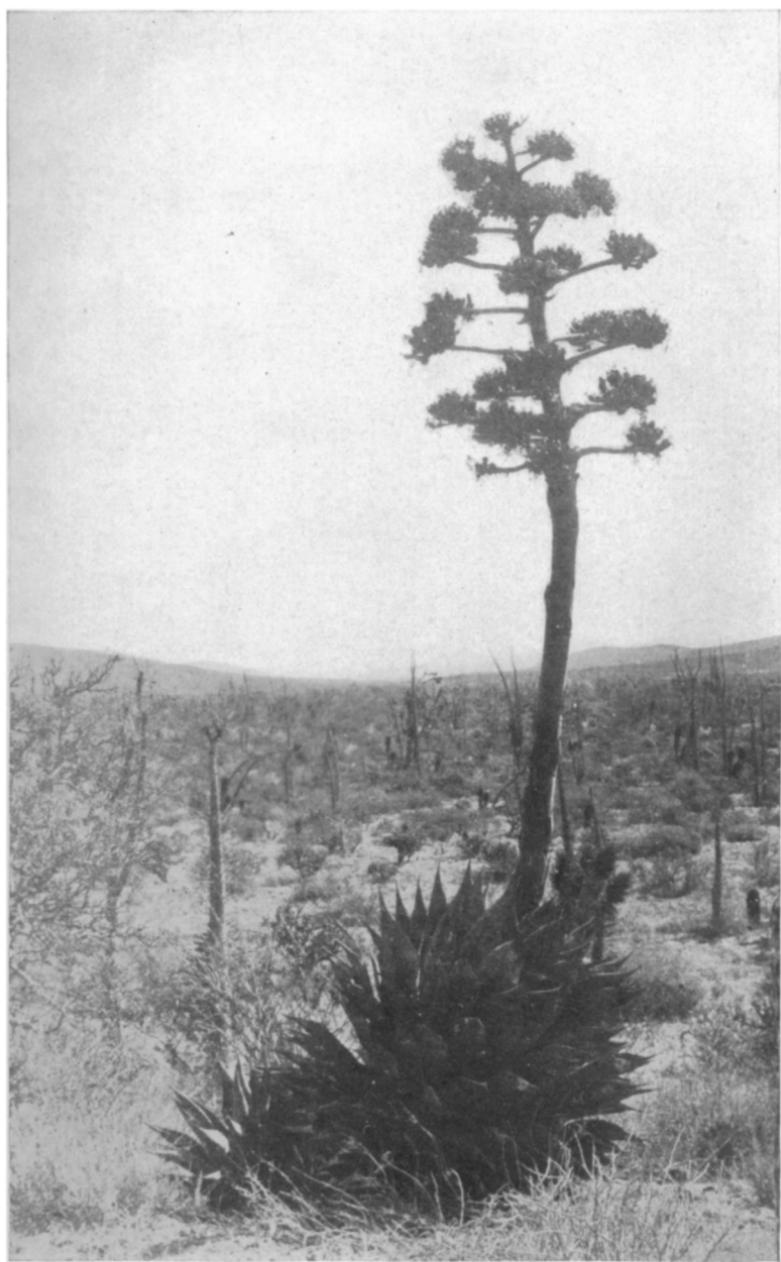
AGAVE SEBASTIANA.



AGAVE PACHYACANTHA.



AGAVE PACHYACANTHA.



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PHOTO. BY E. A. GOLDMAN.

AGAVE GOLDMANIANA.



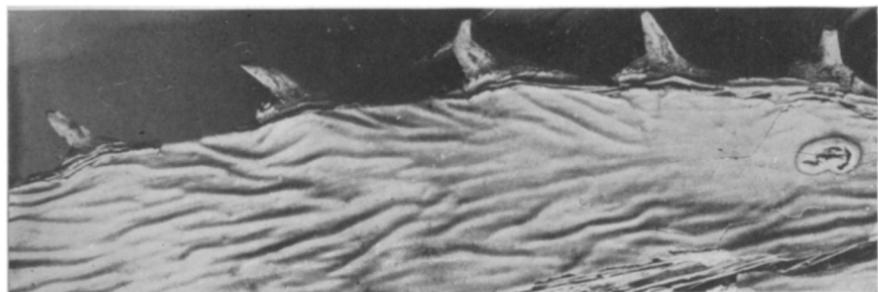
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PLANTS OF MEXICO

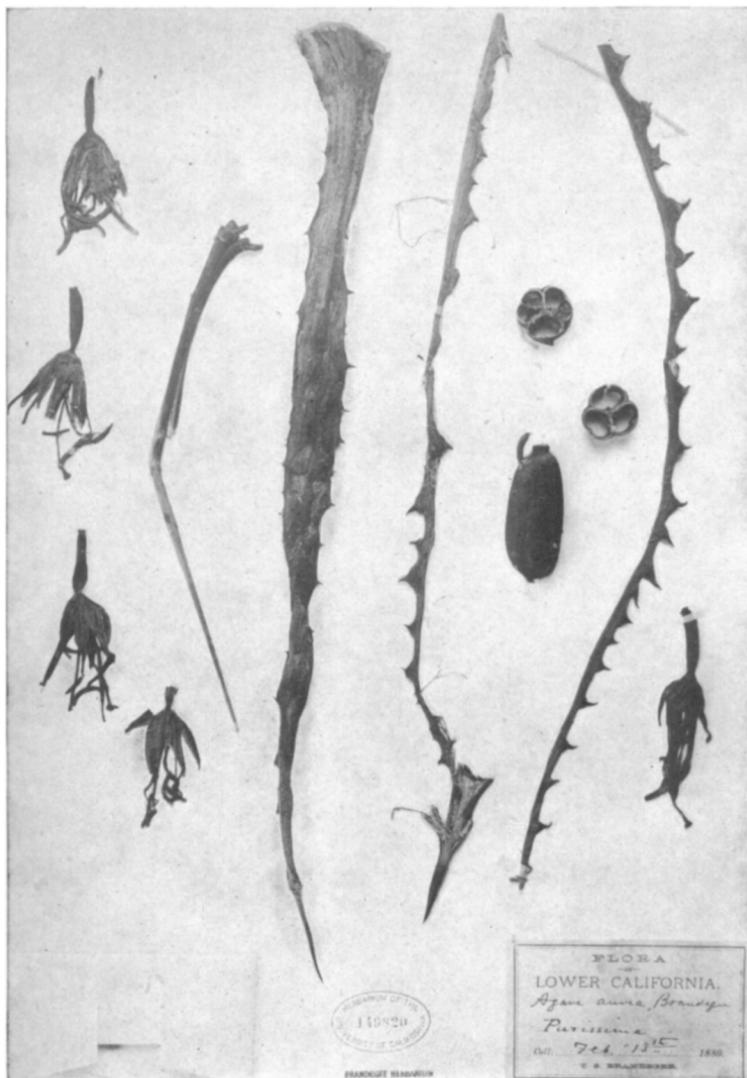
Agave

Lycurgo, 80 miles S. E. of Chihuahua
2000 ft. Alt.
No. 7227
September 6, 1907

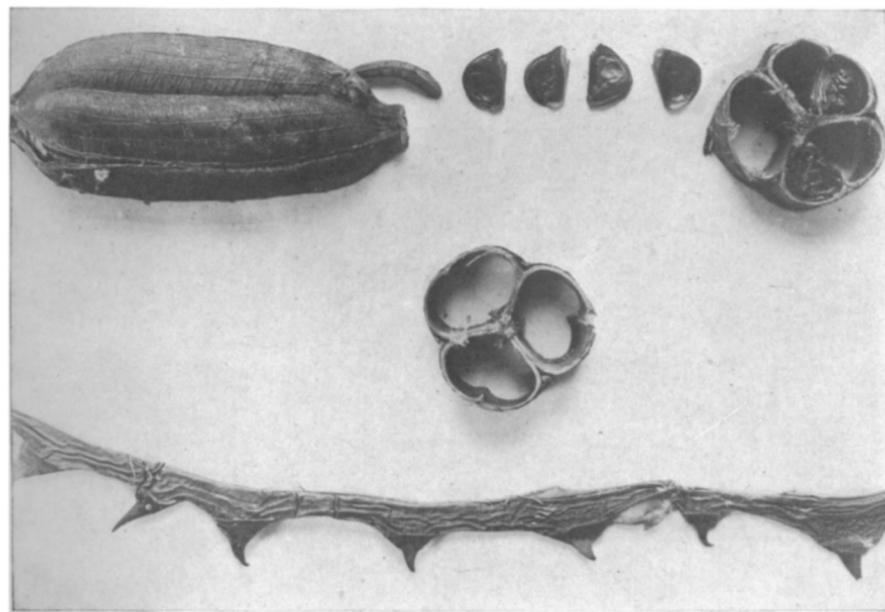
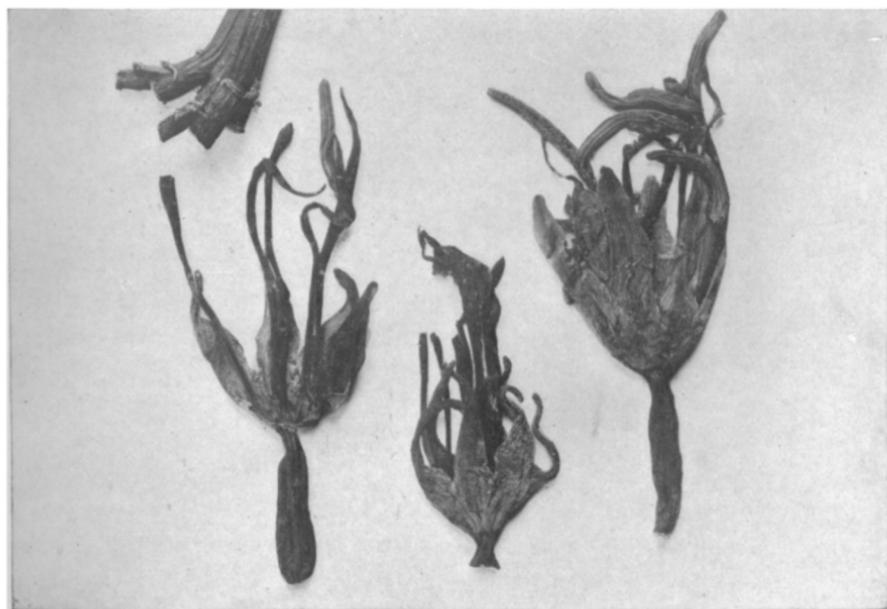
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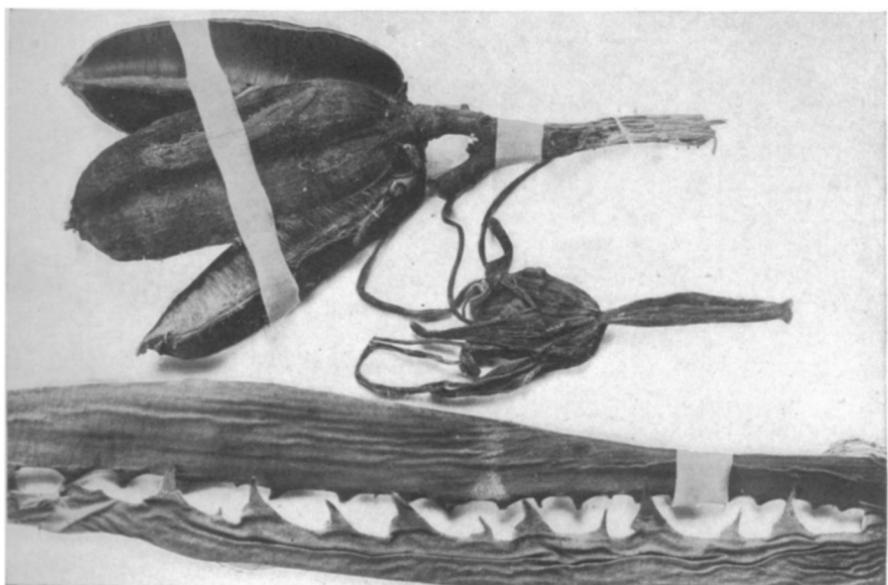
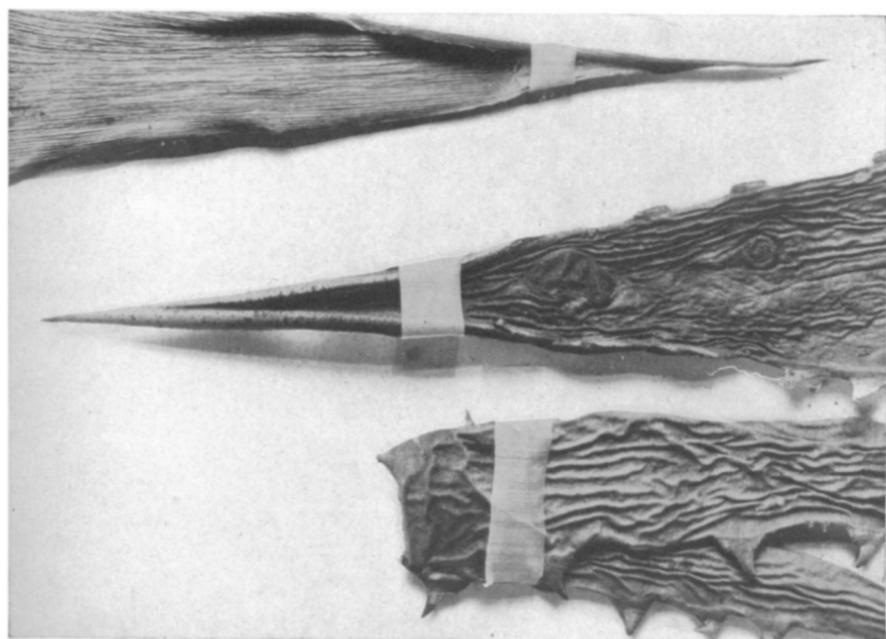
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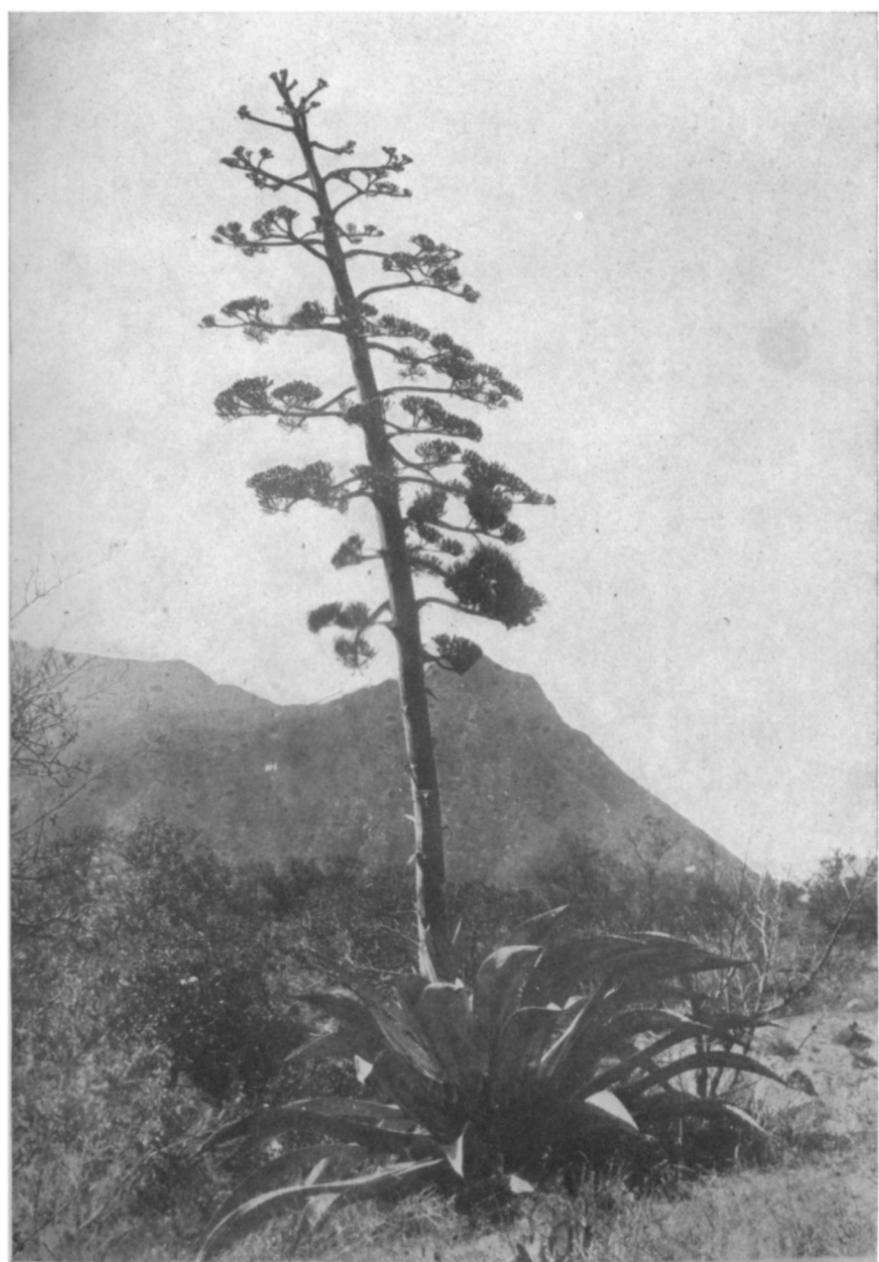
FLORA
LOWER CALIFORNIA.
Agave aurea, Boedinger
Peruviana
Coll. Dec. 1885 1888
C. S. BOEDINGER



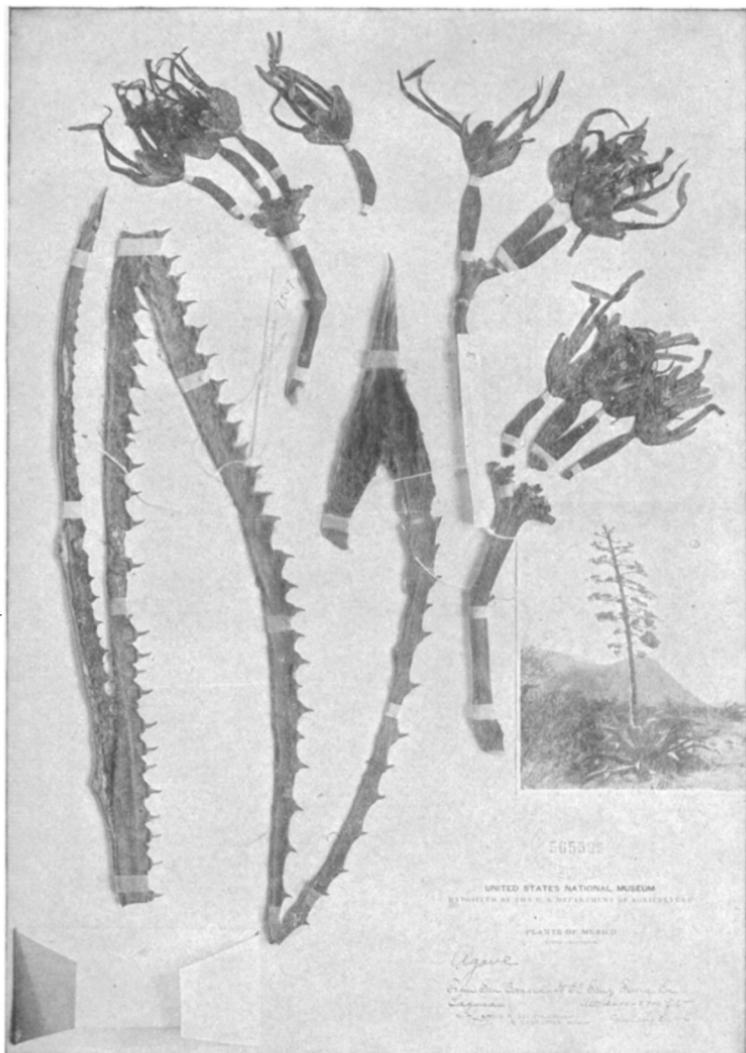
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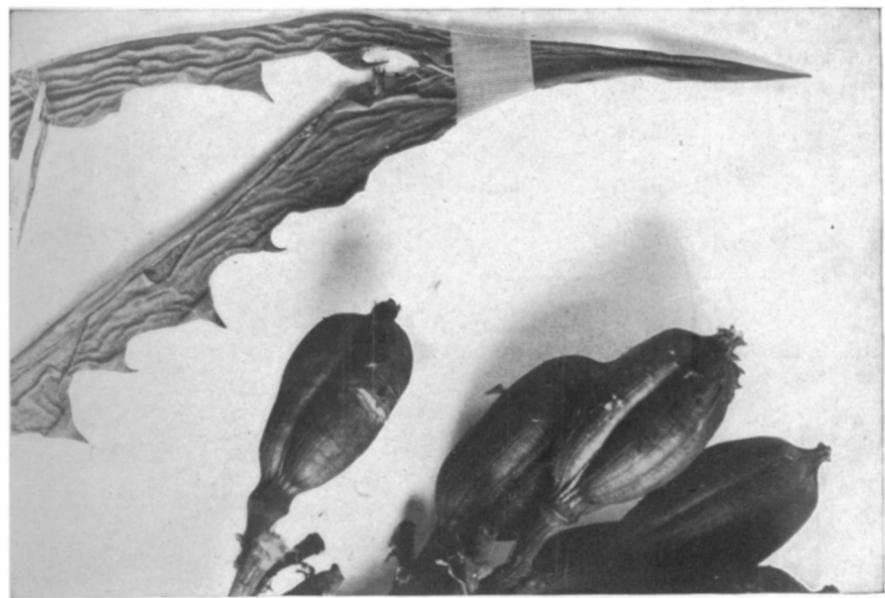
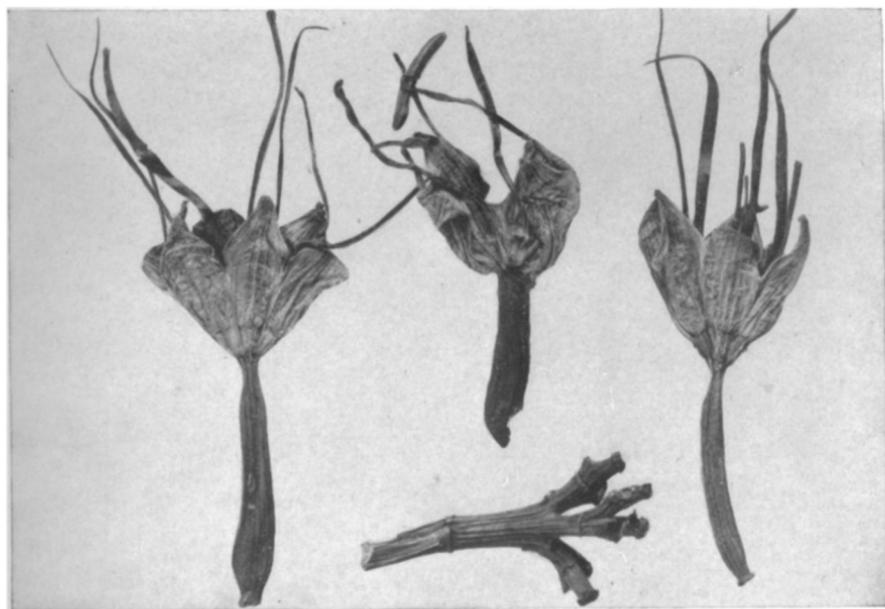
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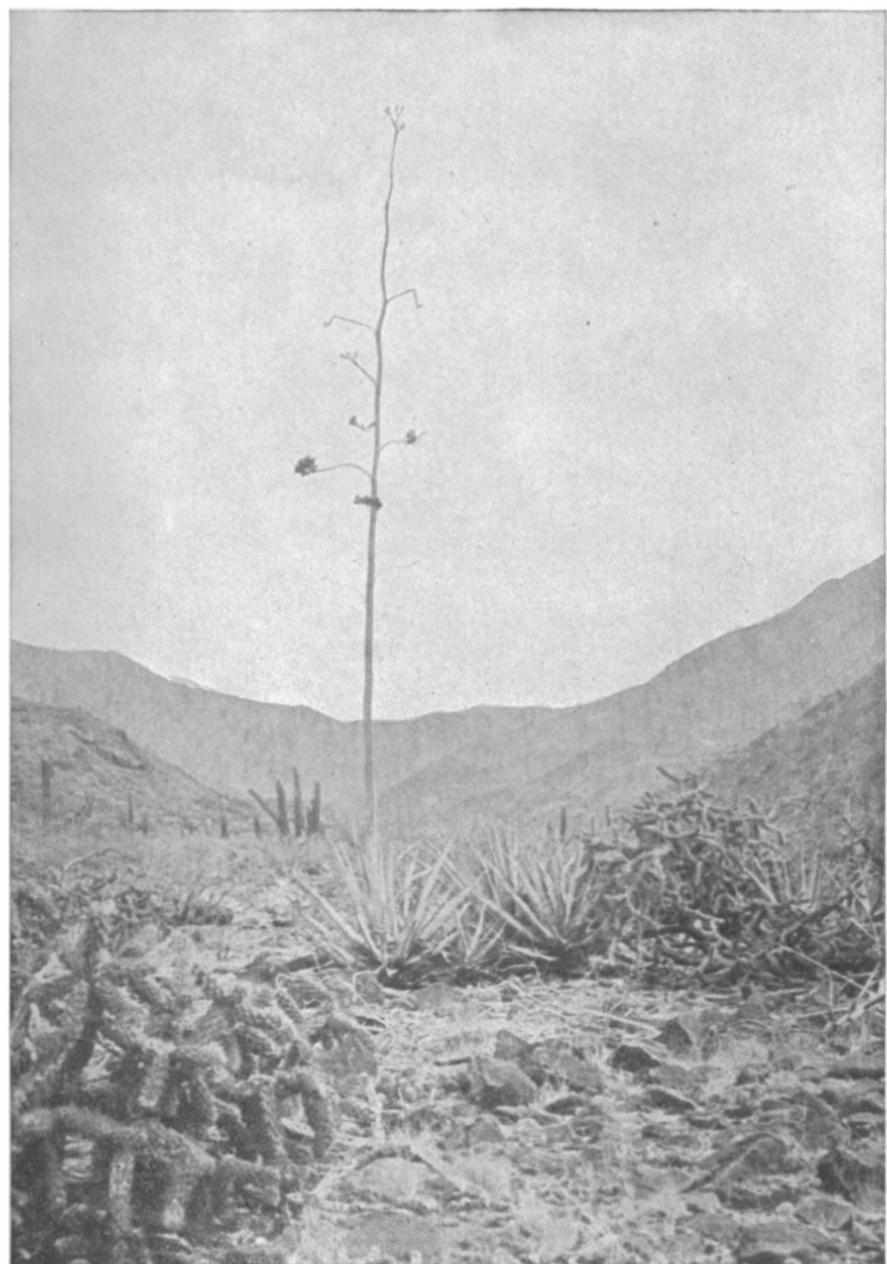
By Permission of Bureau of Biological Survey.
PHOTO. BY E. A. GOLDMAN.
AGAVE PROMONTORII.



AGAVE PROMONTORII.



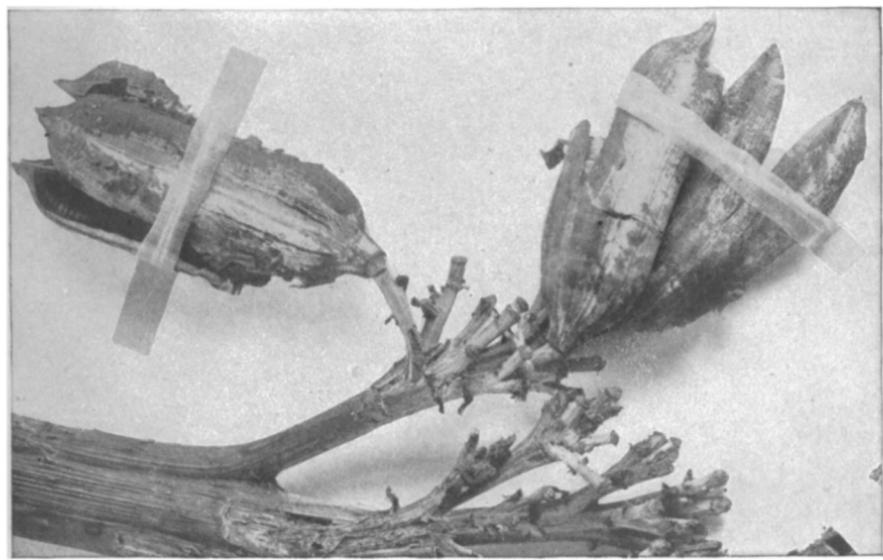
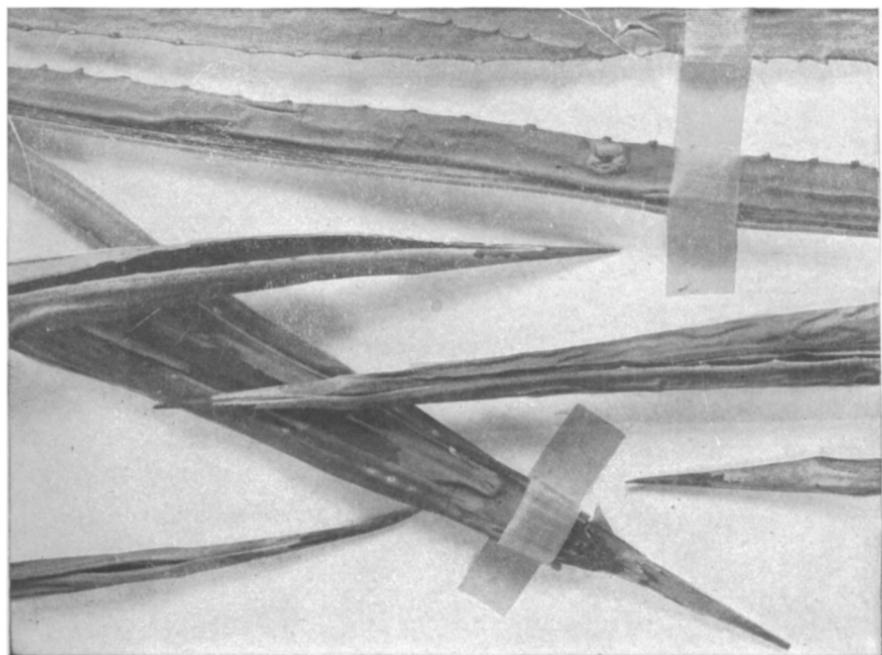
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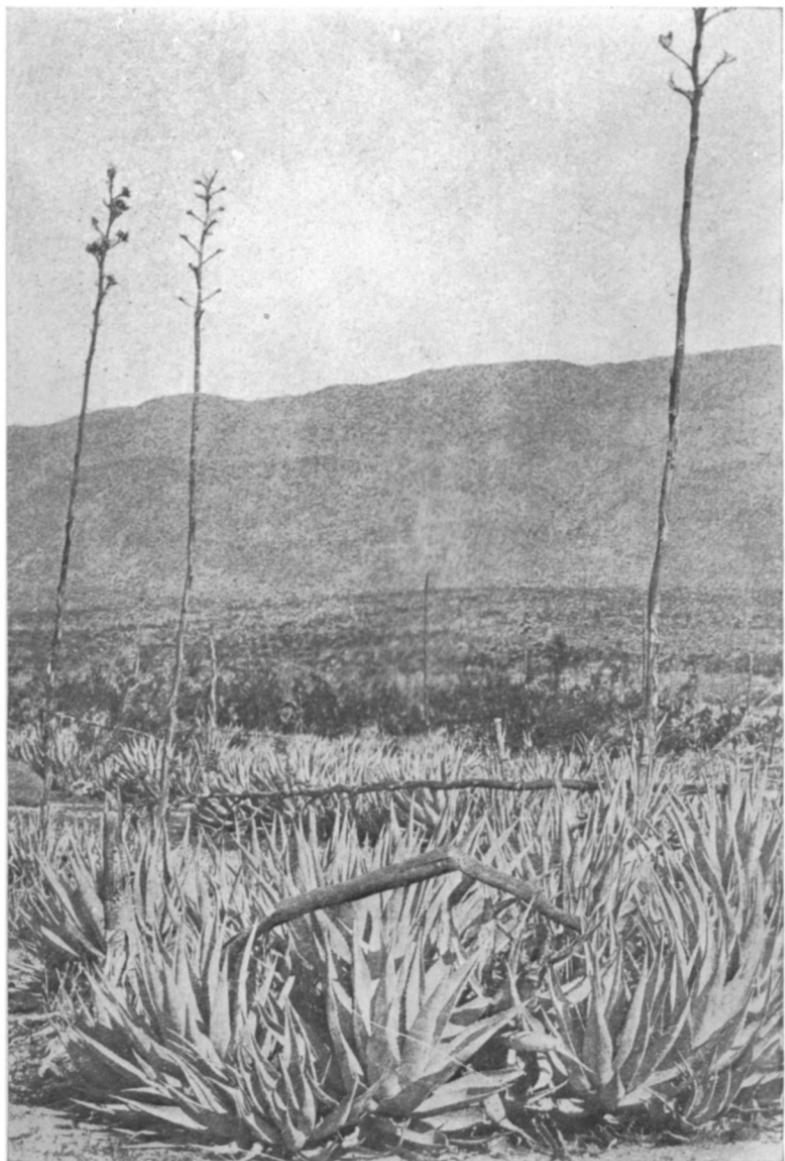
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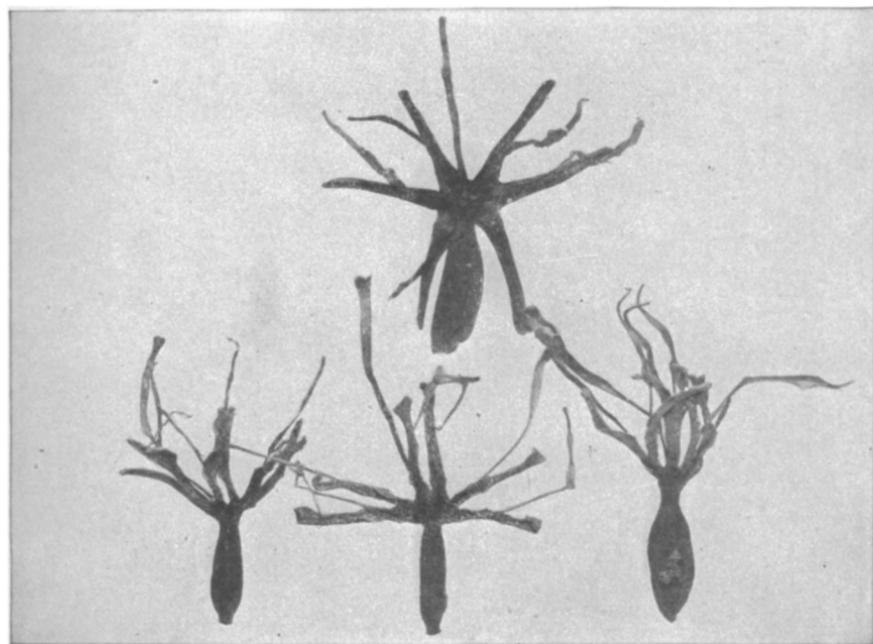
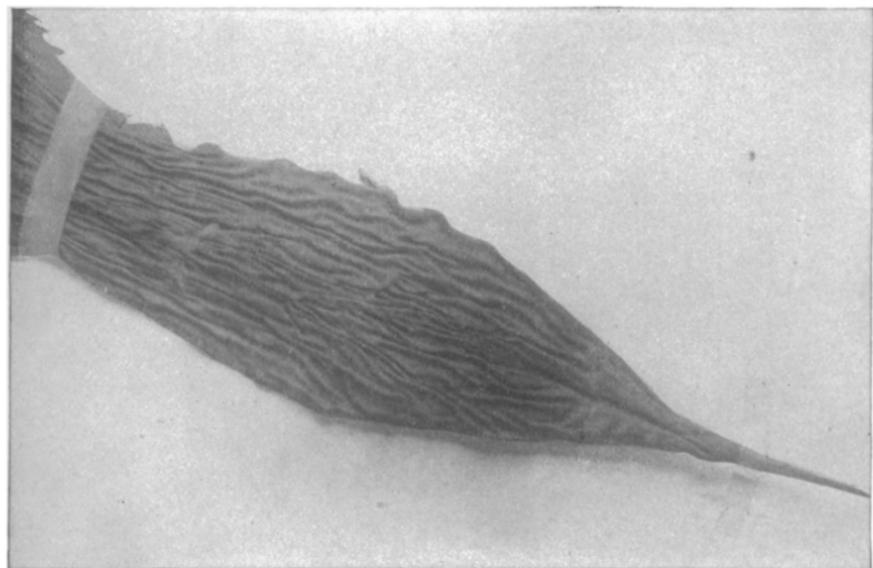
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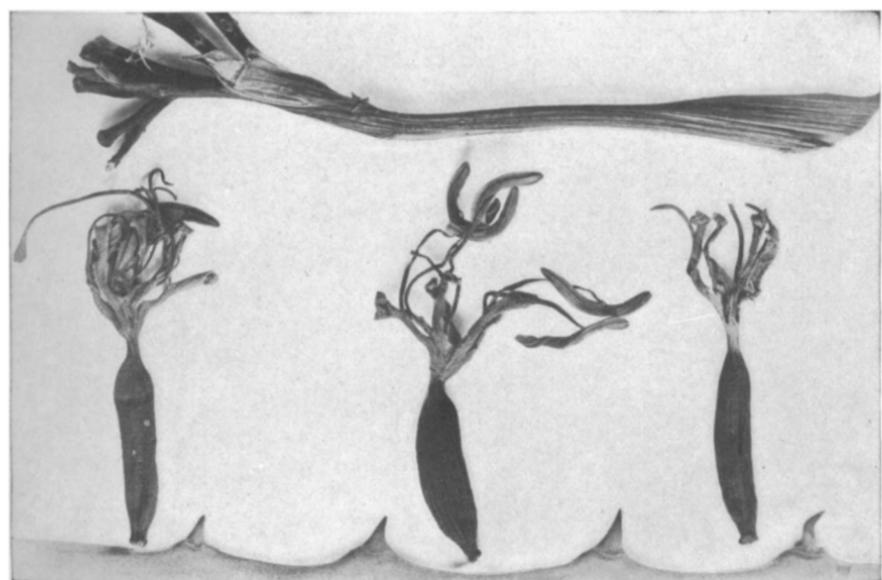
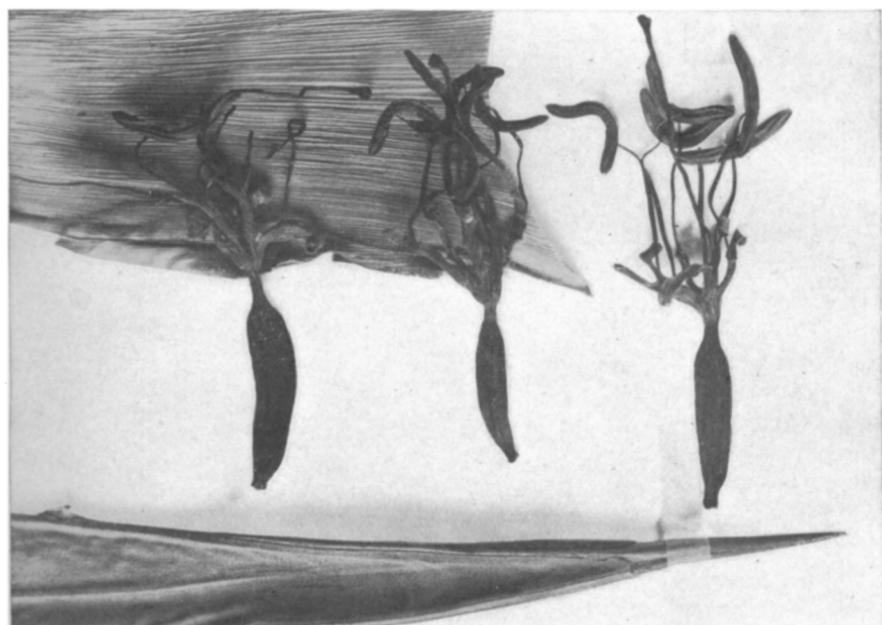
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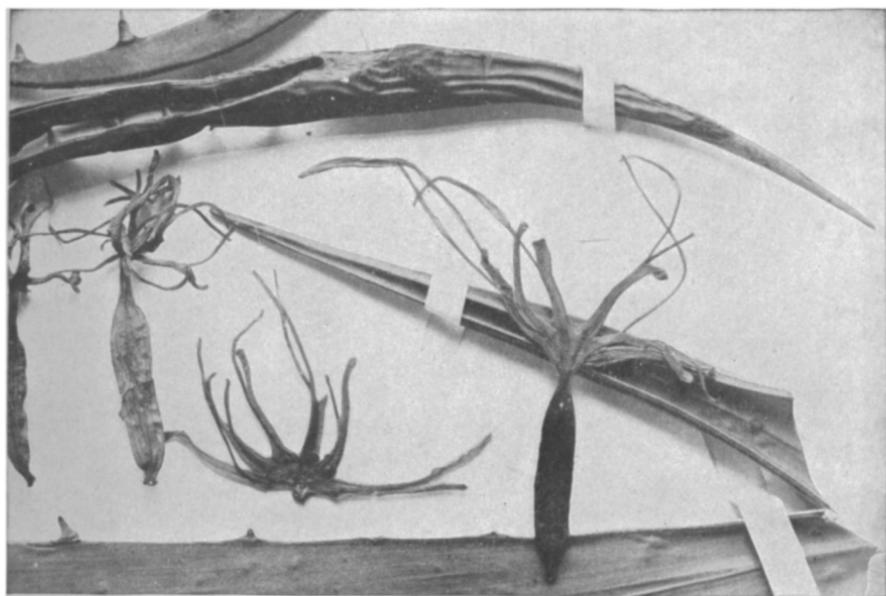
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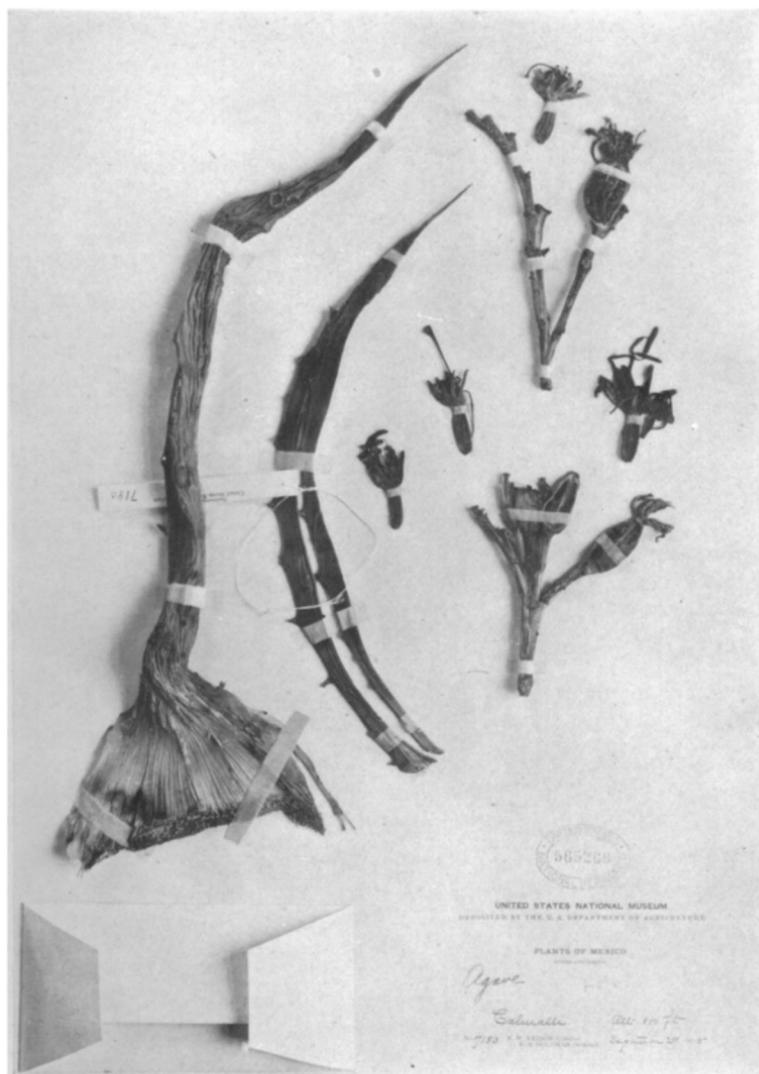
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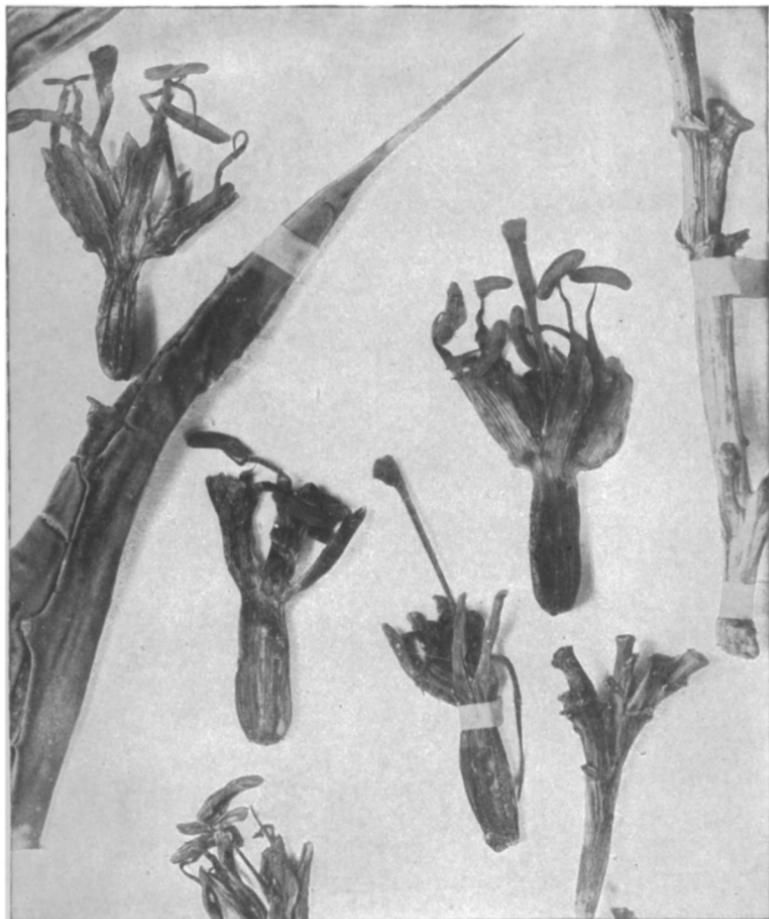
AGAVE CONSOCIATA.



AGAVE PRINGLEI.



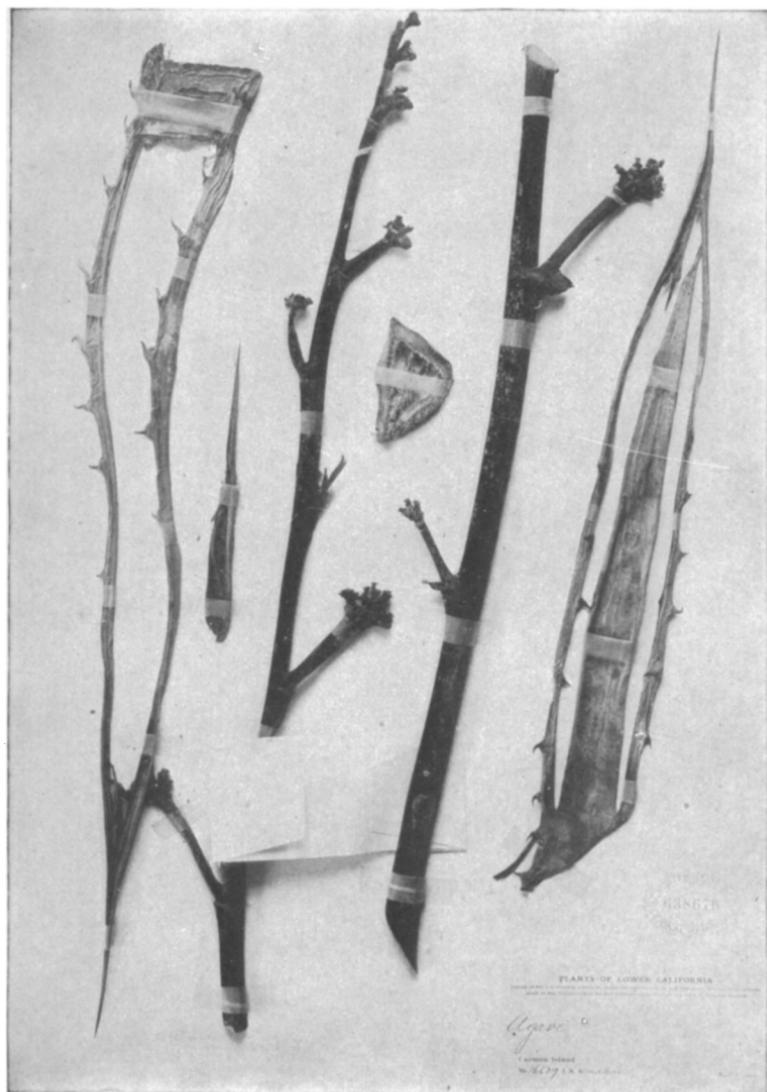
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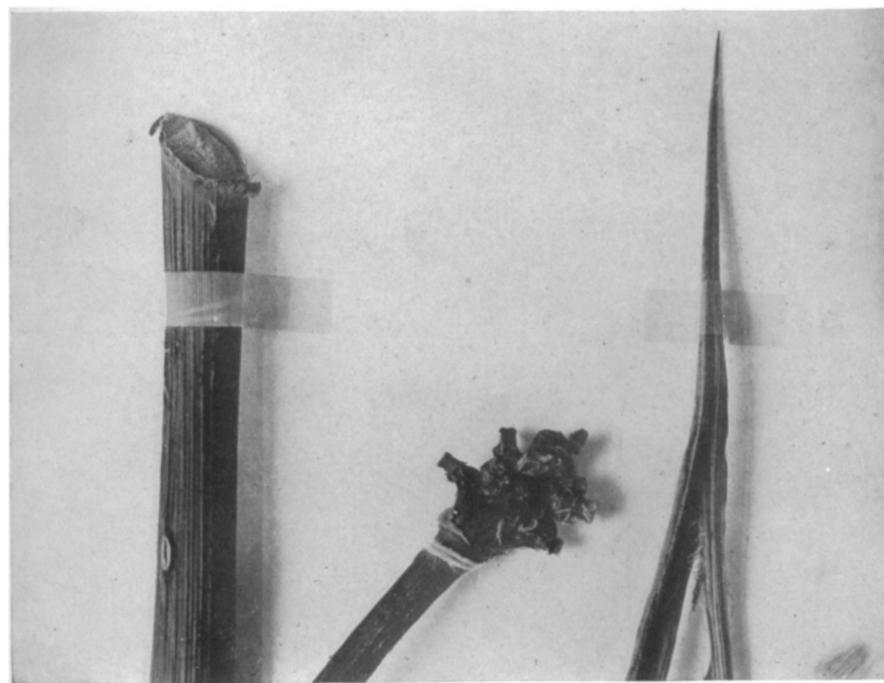
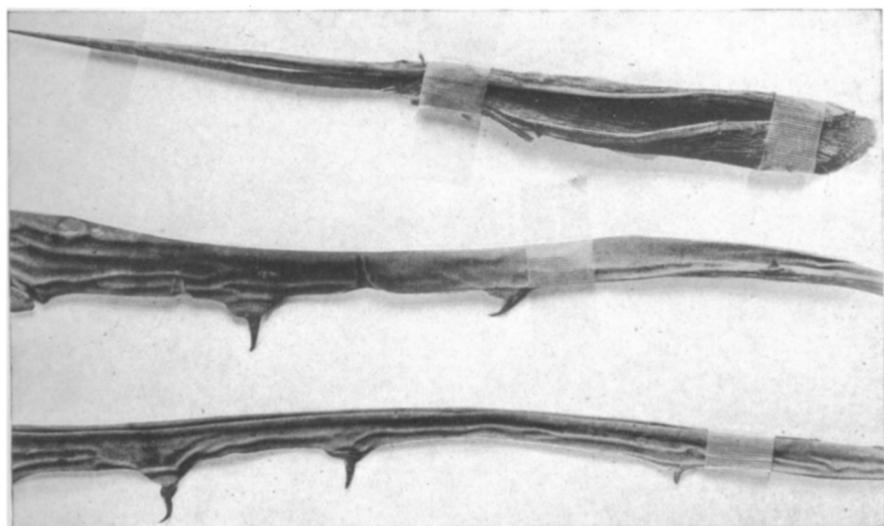
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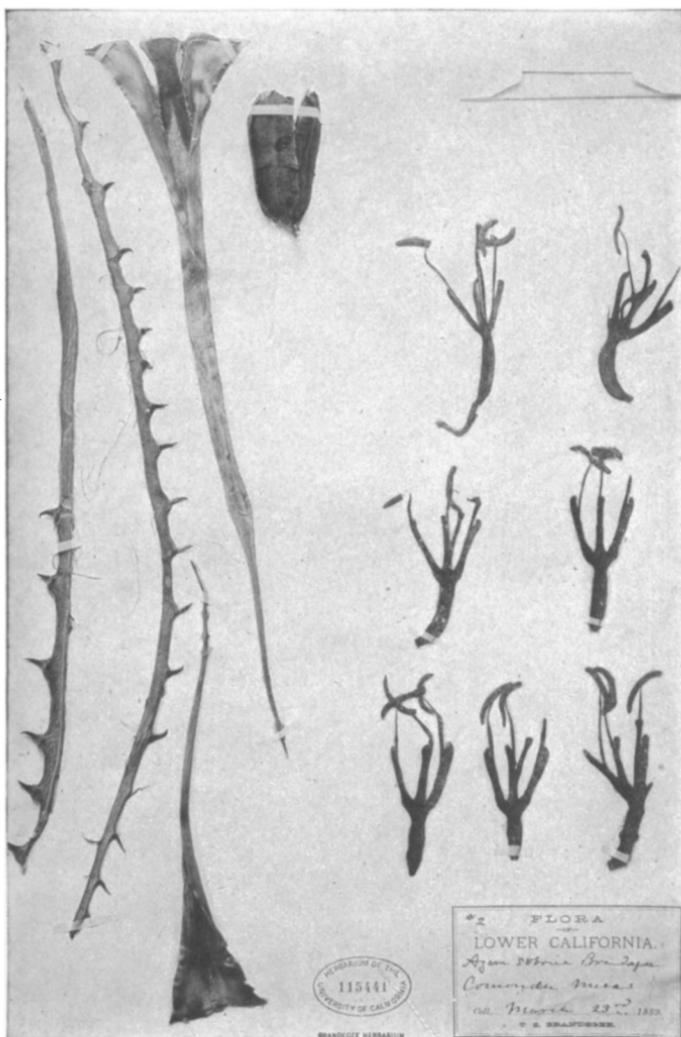
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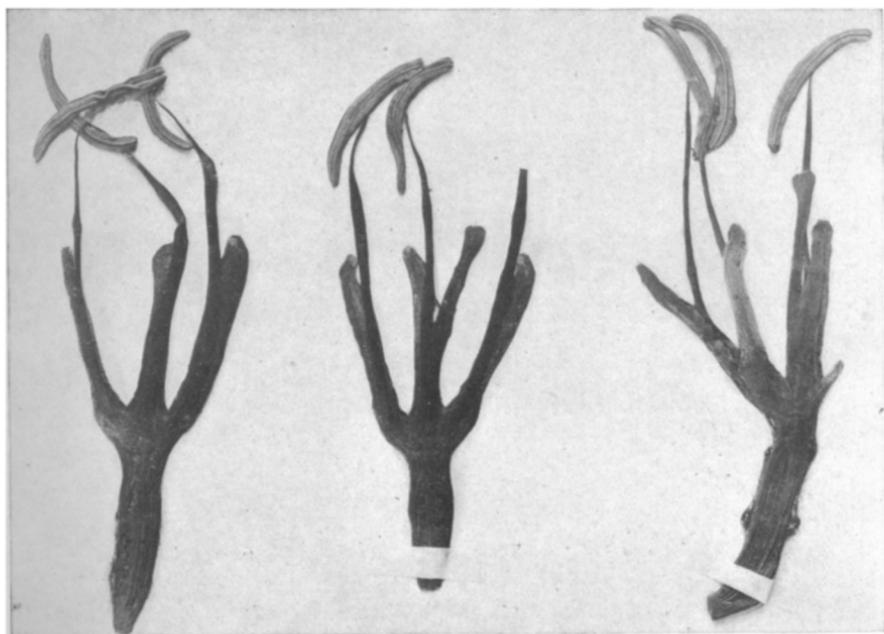
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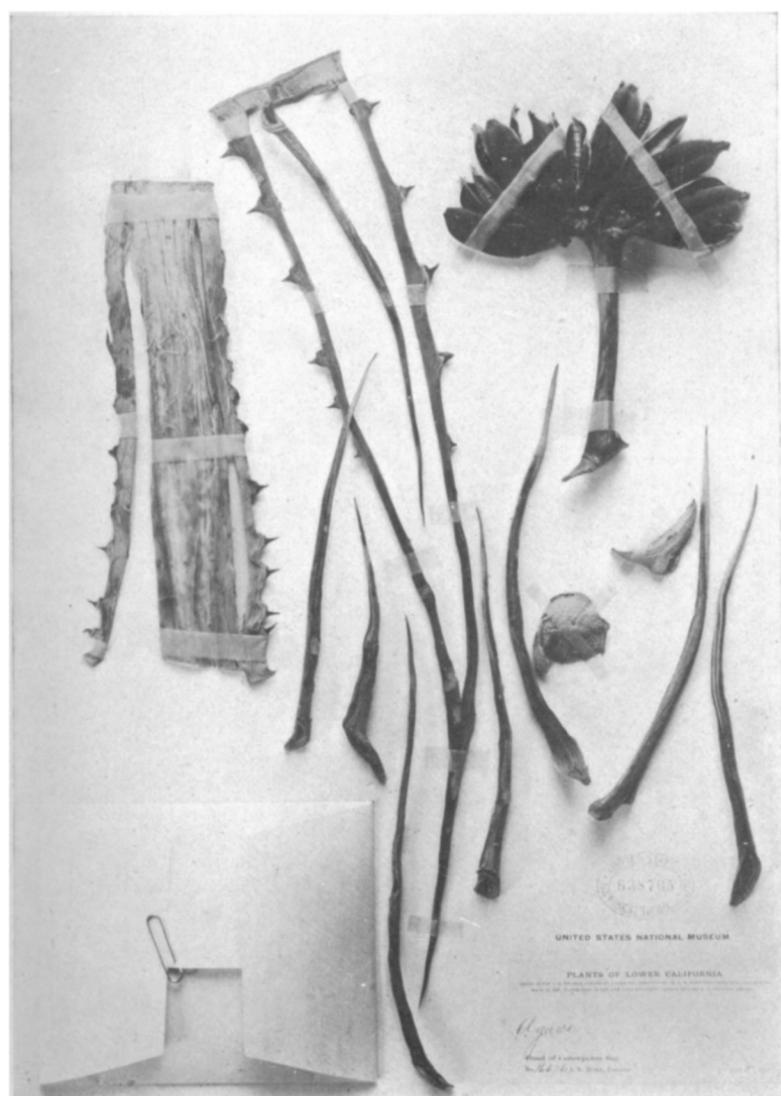
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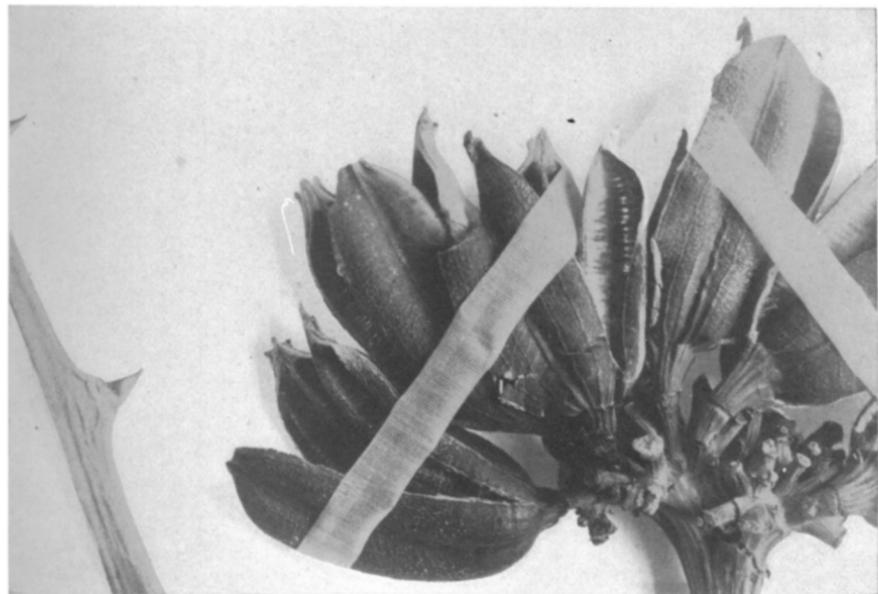
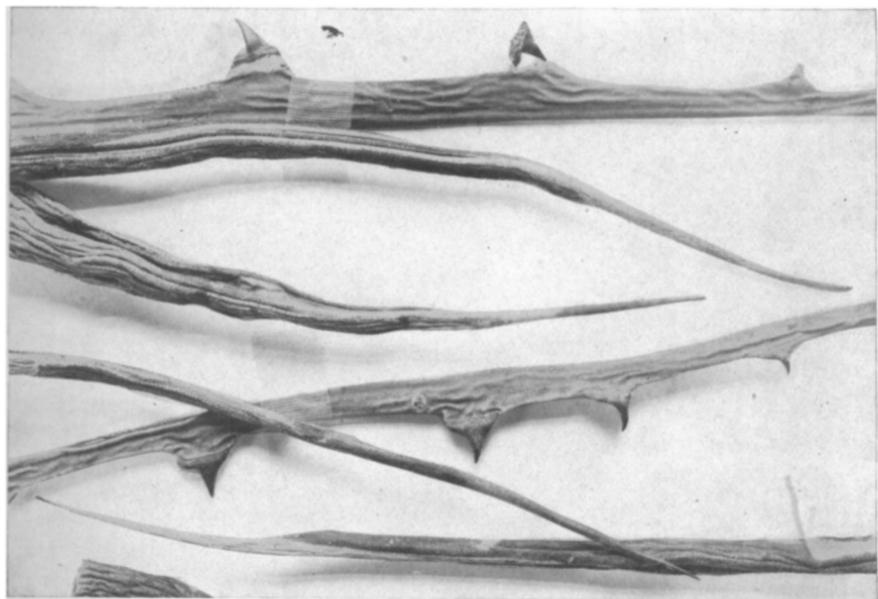
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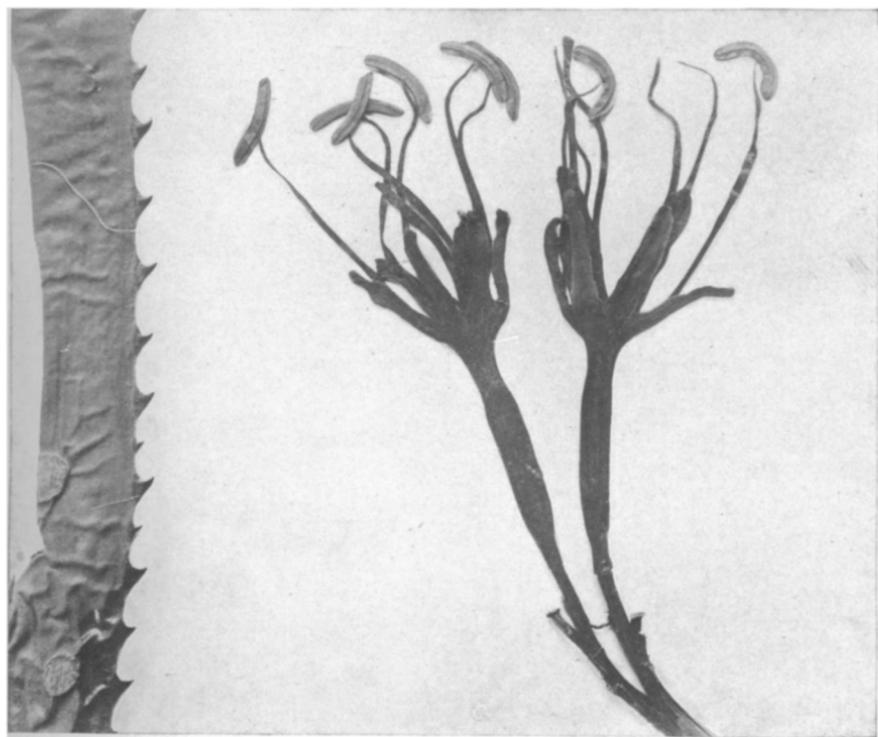
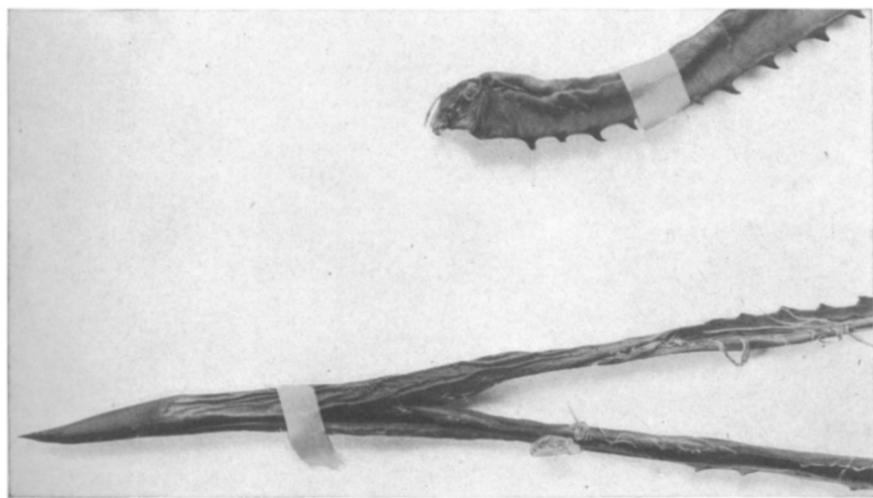
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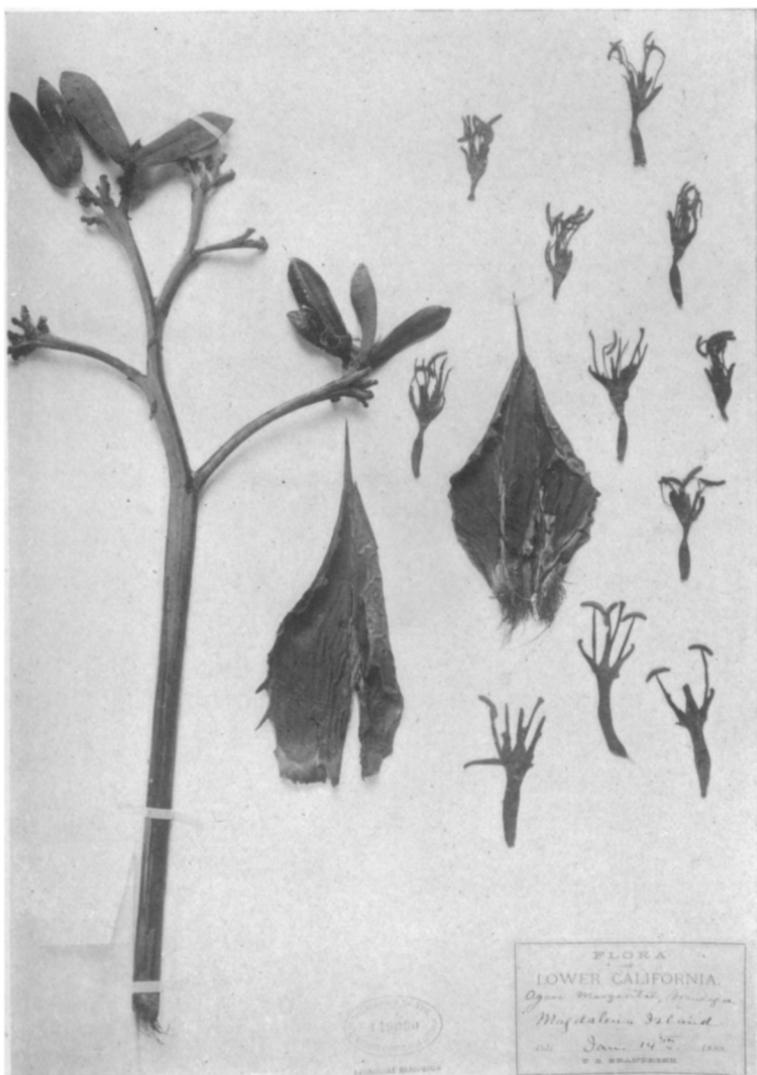
AGAVE AFFINIS.



AGAVE AFFINIS.

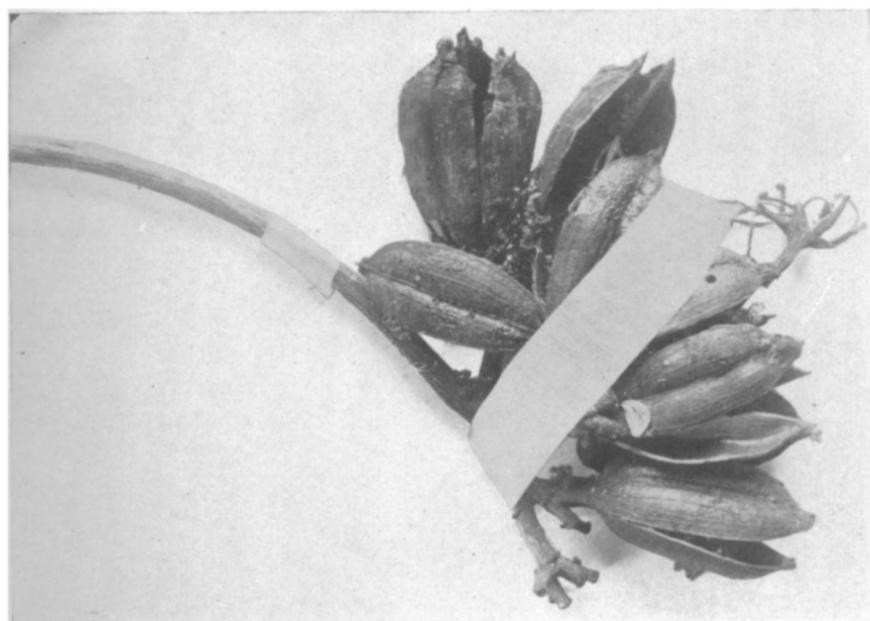
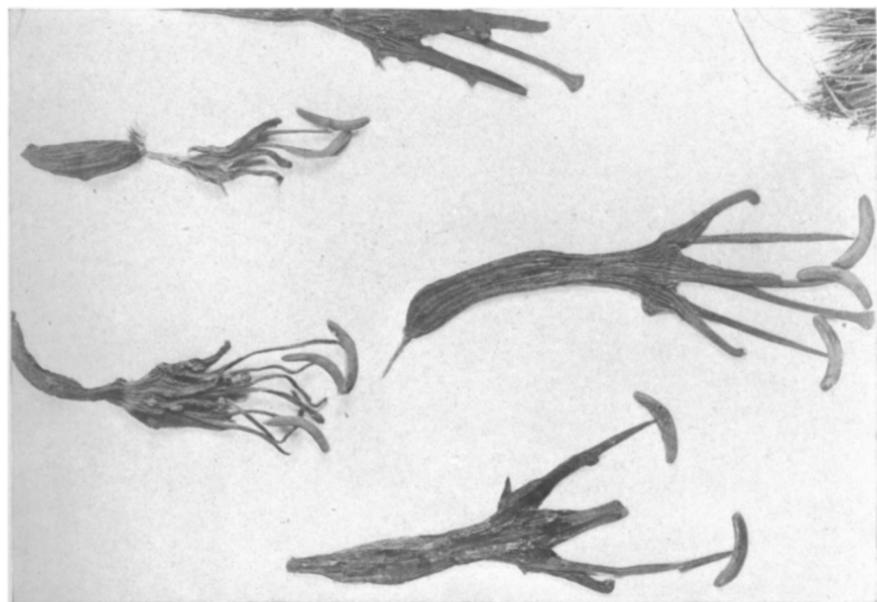


AGAVE BRANDEGEEI.

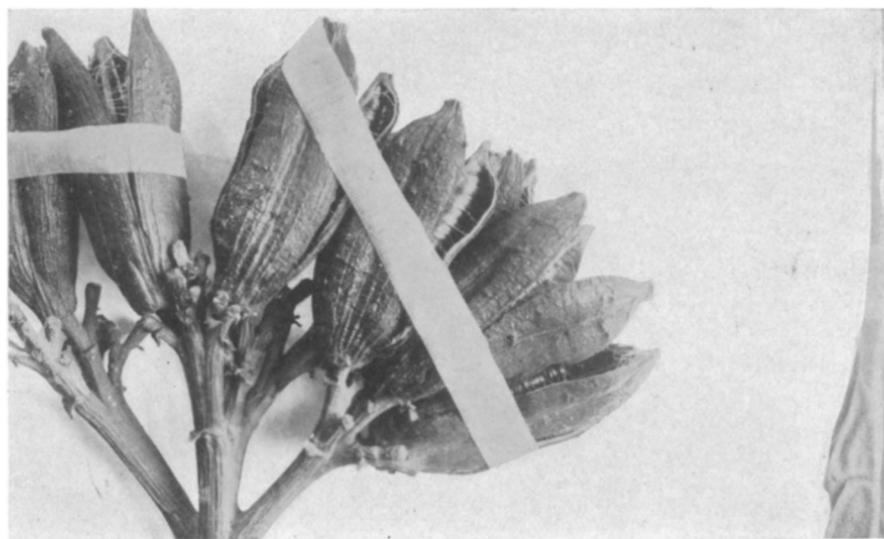
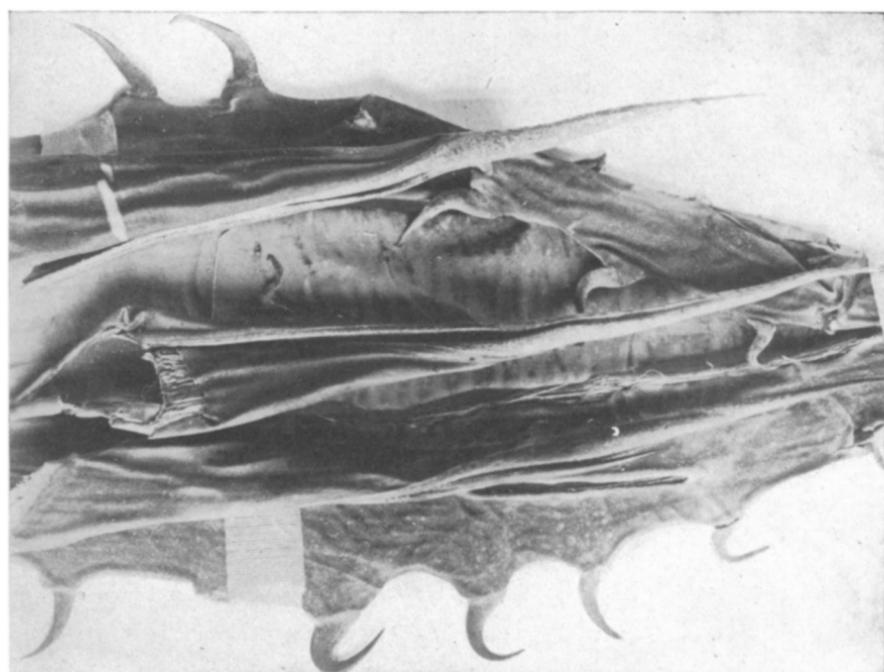


FLORA
LOWER CALIFORNIA.
Agave Margaritae, Grisebach.
Magdalena Island
Collected Jan. 14th 1880
W. A. BRADDOCK

AGAVE MARGARITAE.



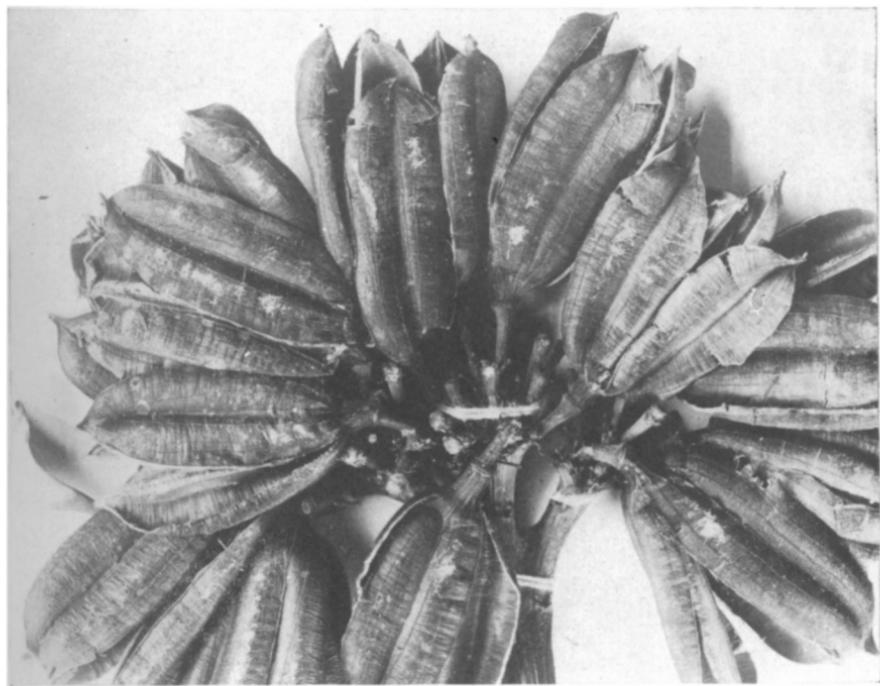
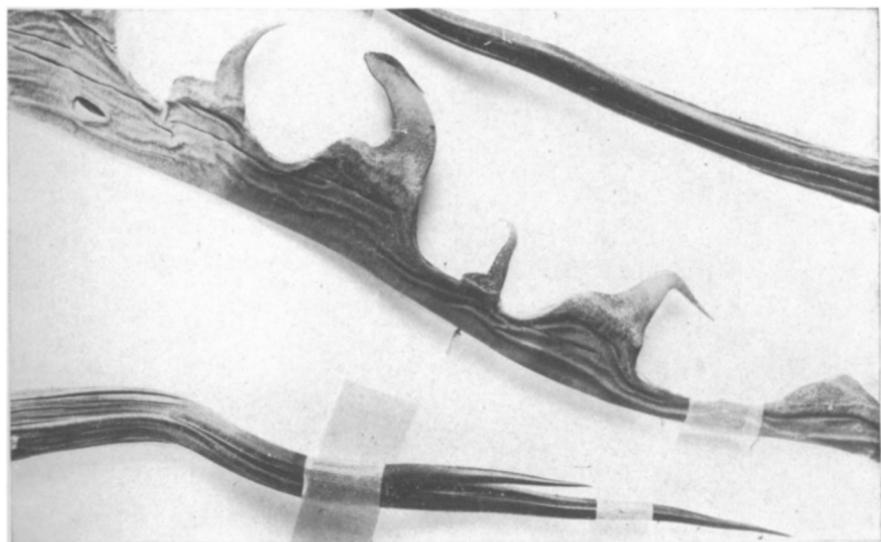
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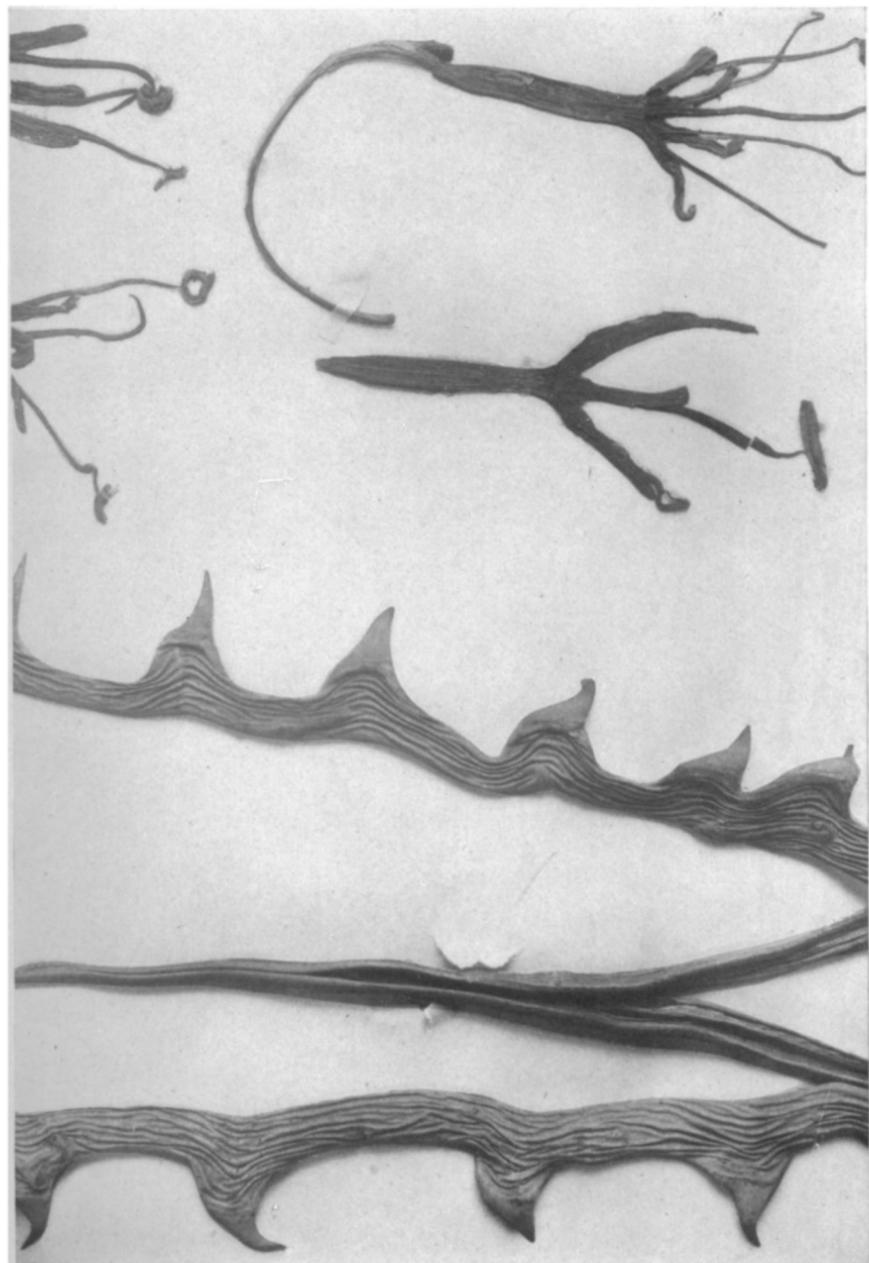
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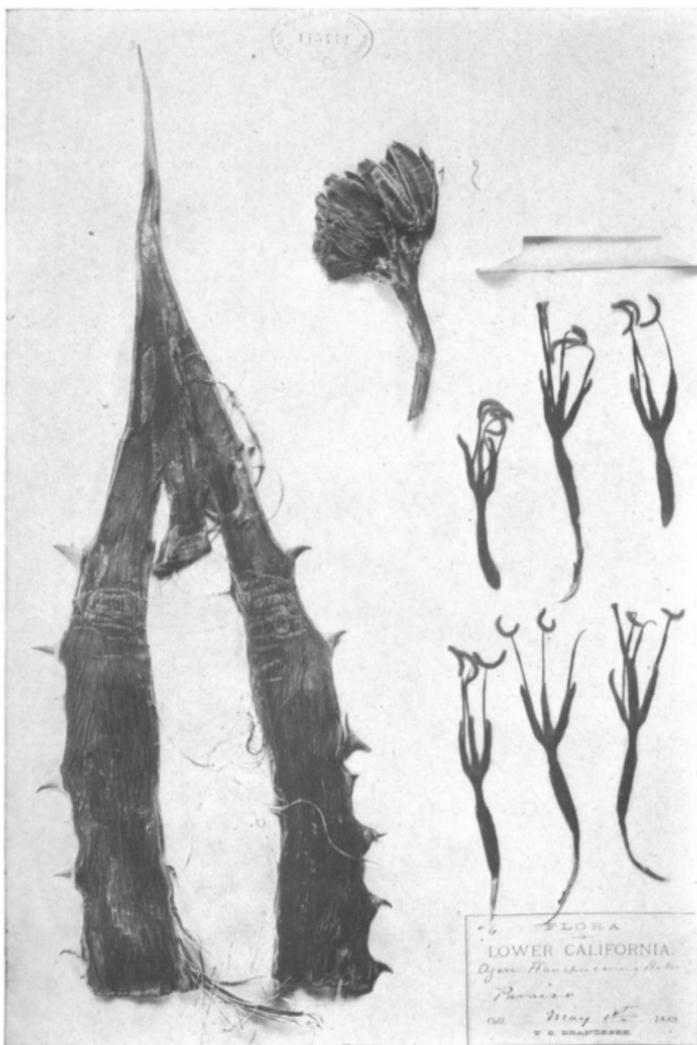
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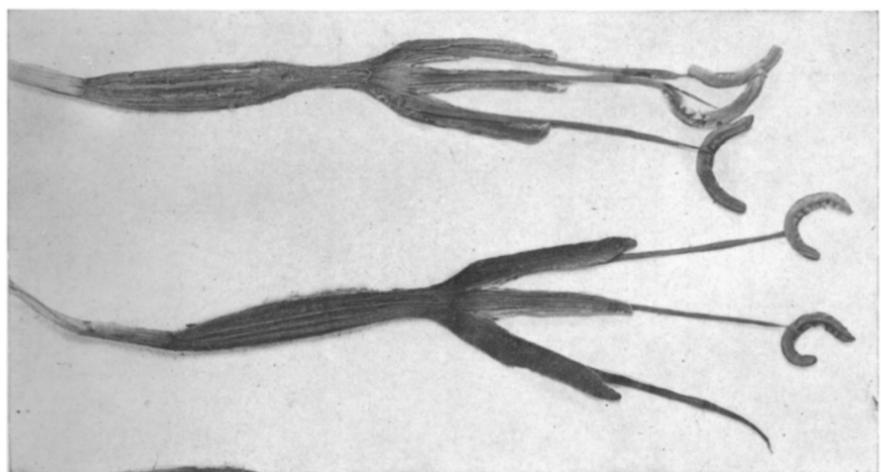
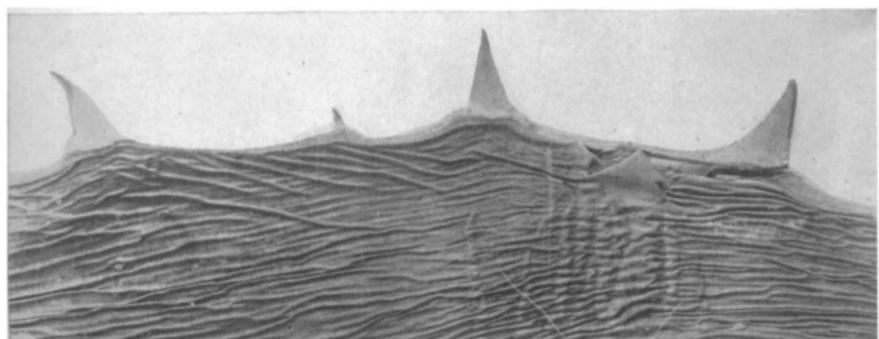
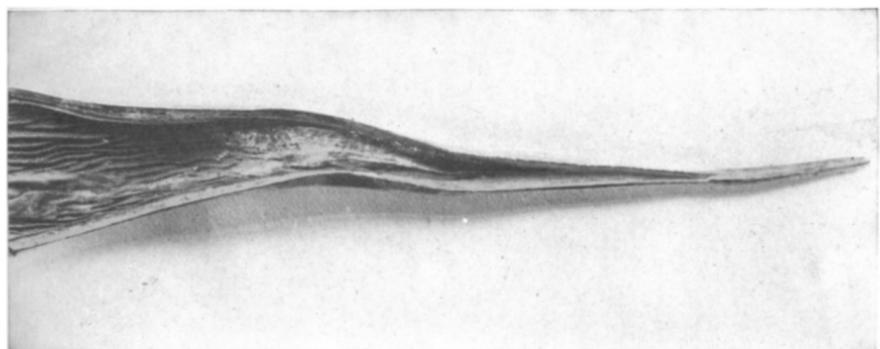
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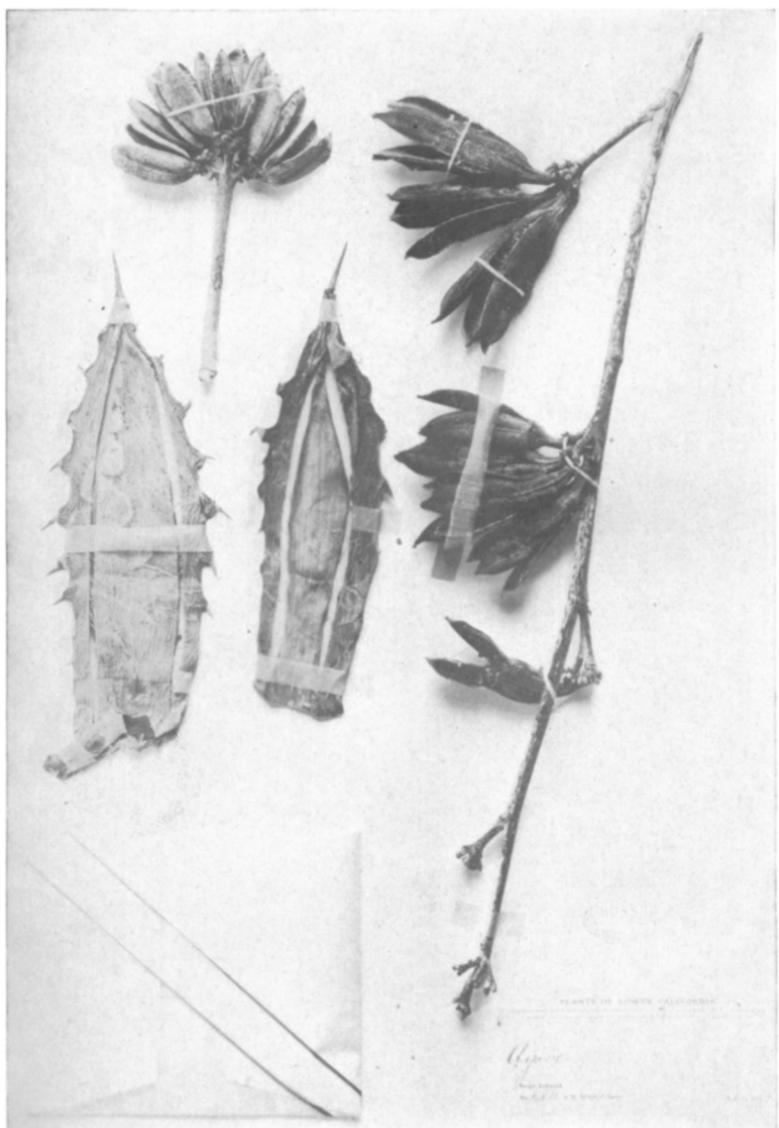
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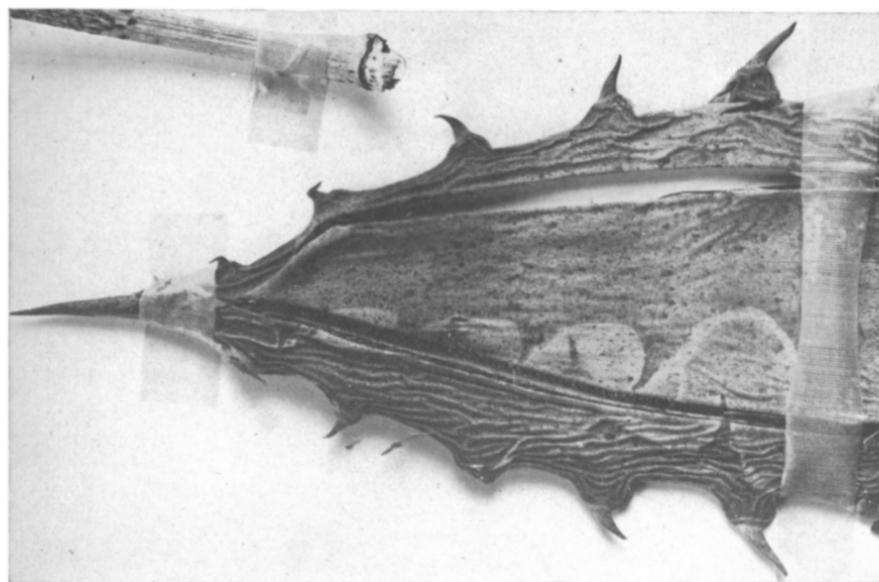
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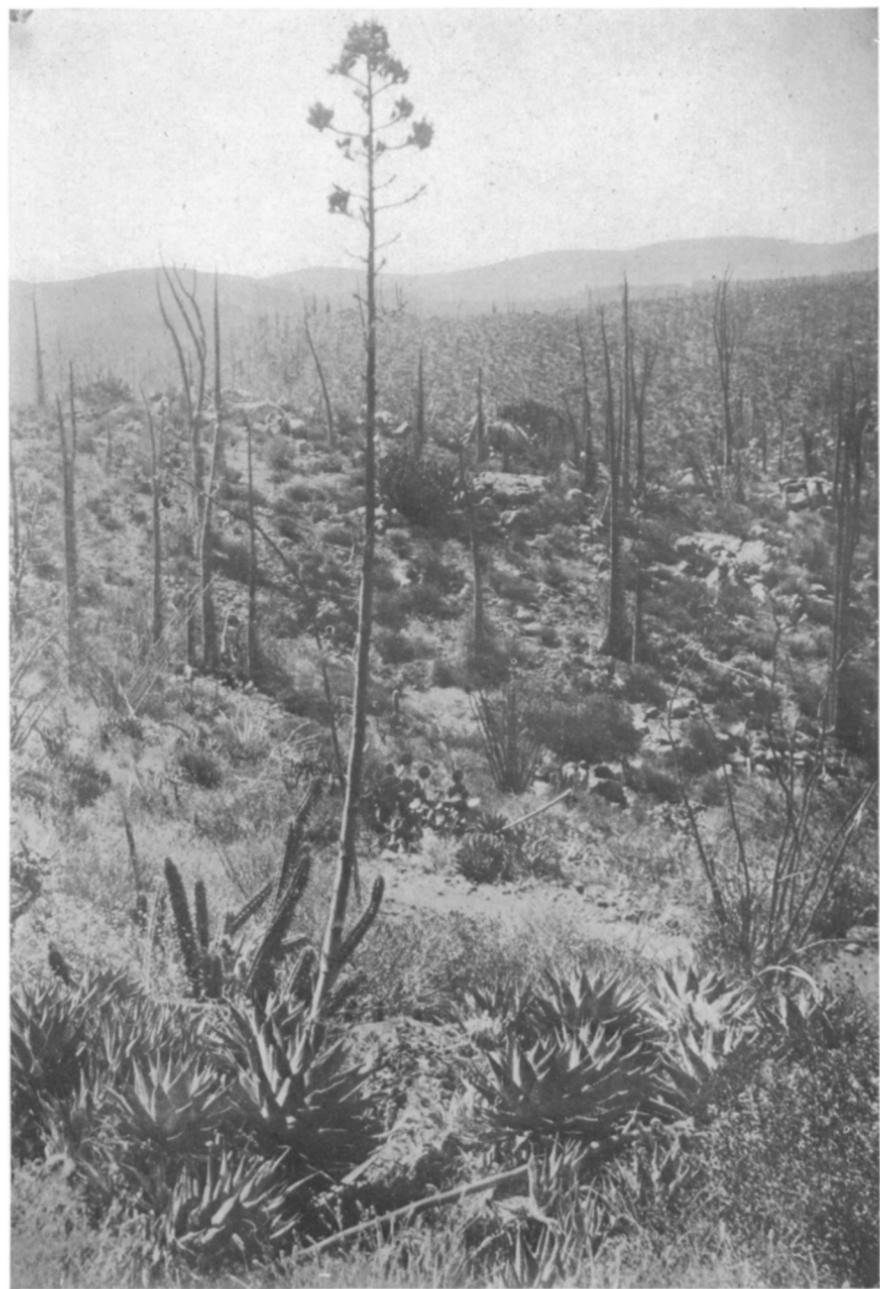
AGAVE AVELLANIDENS.



AGAVE SUBSIMPLEX.



AGAVE SUBSIMPLEX.

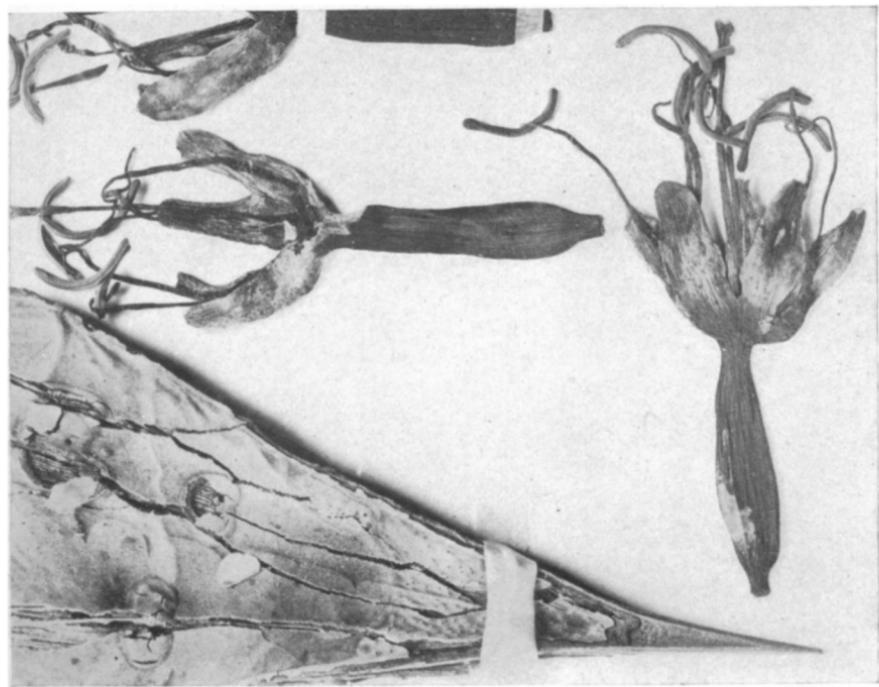


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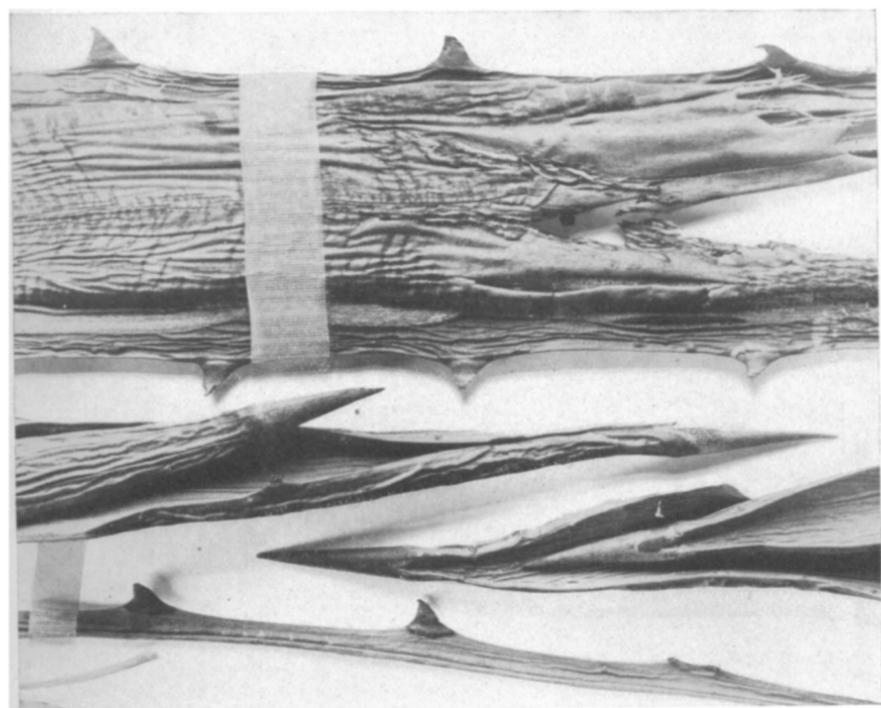
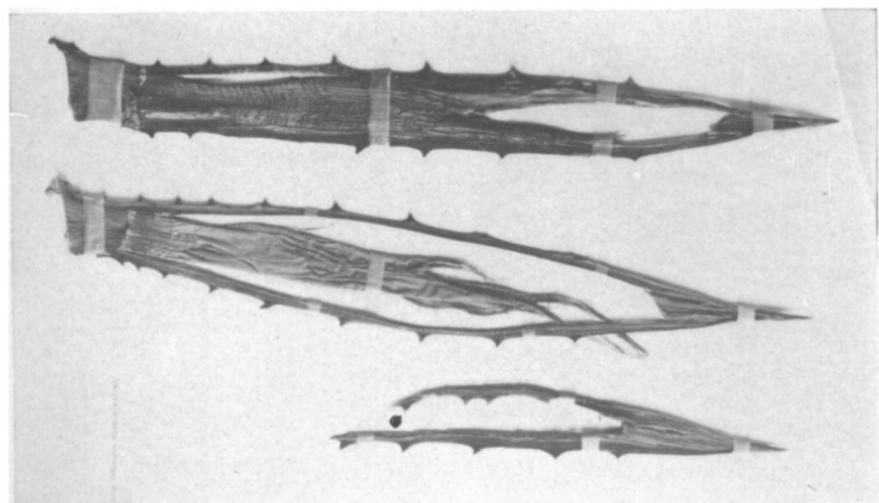
By Permission of Bureau of Biological Survey.
PHOTO. BY E. A. GOLDMAN.



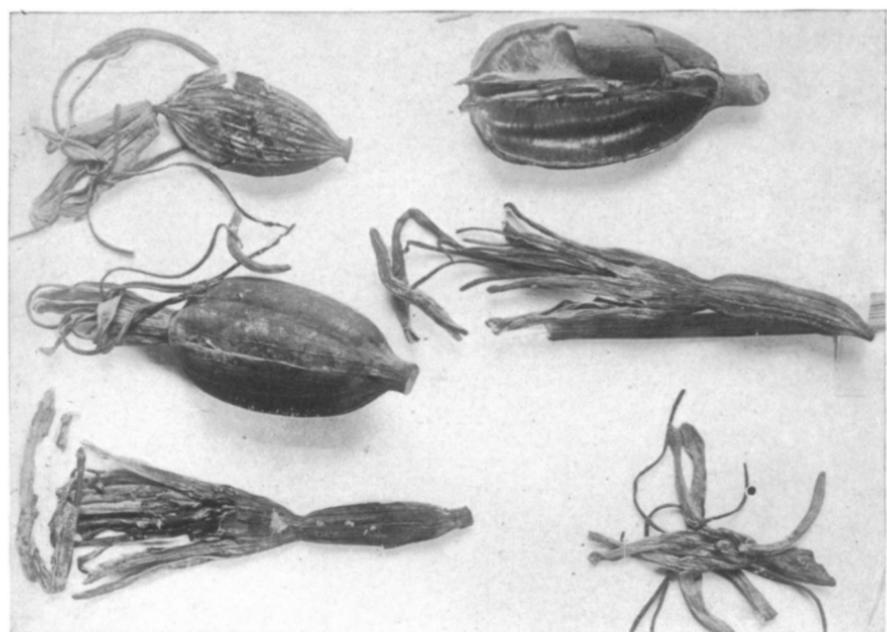
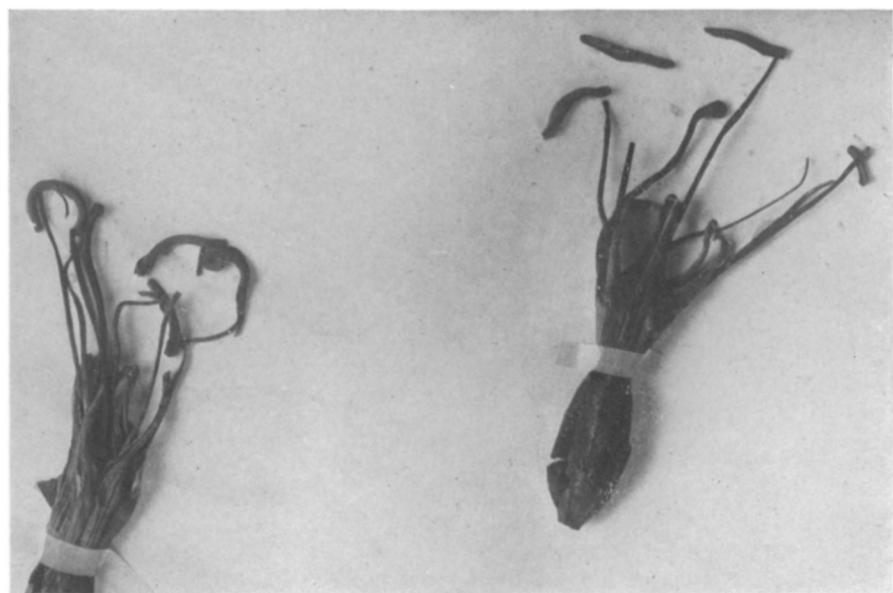
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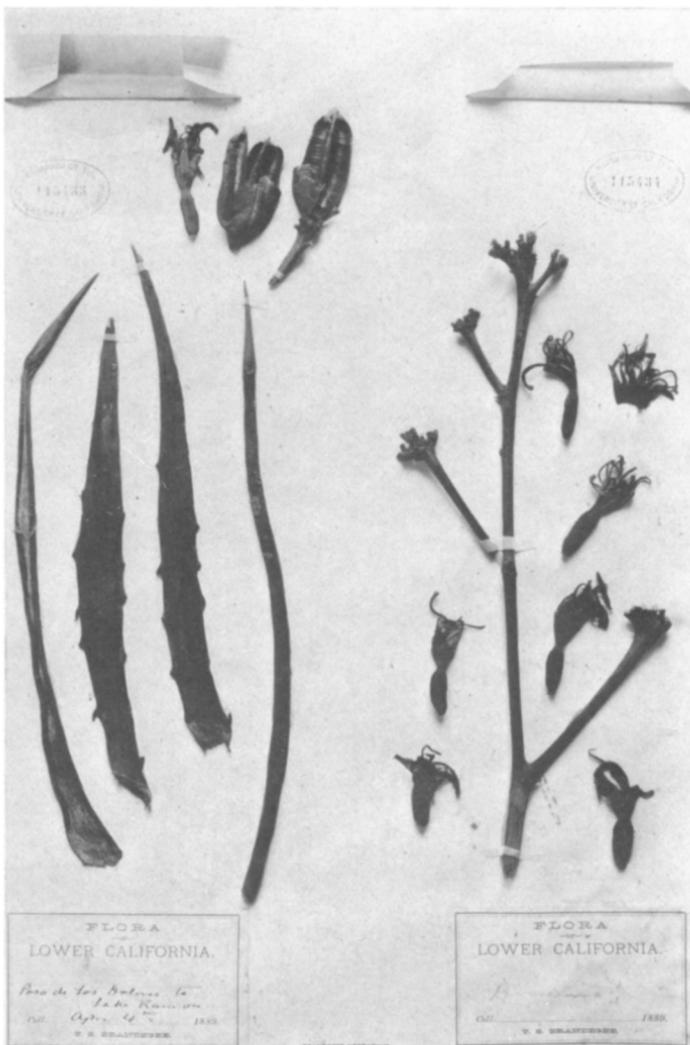
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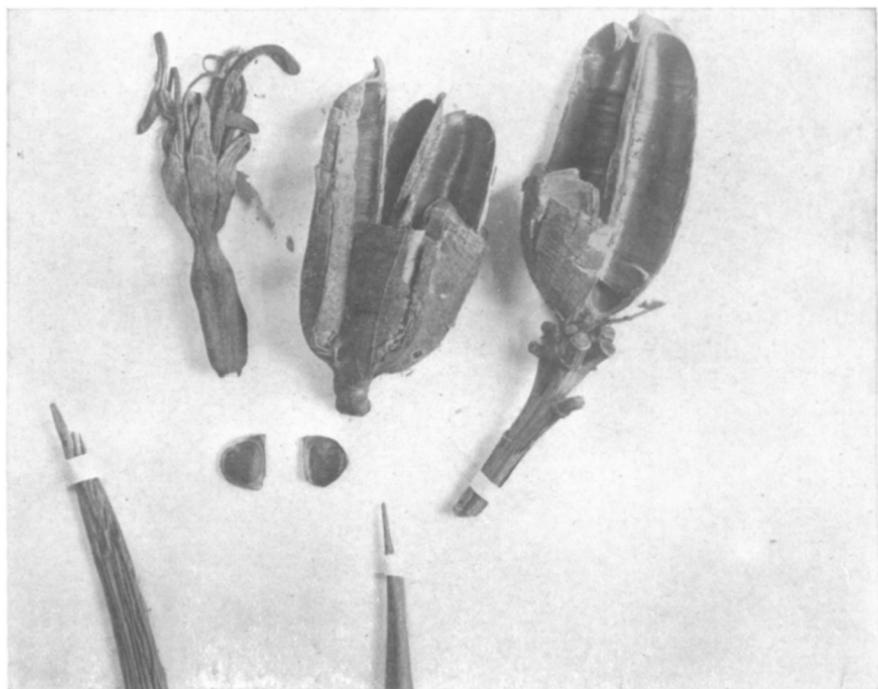
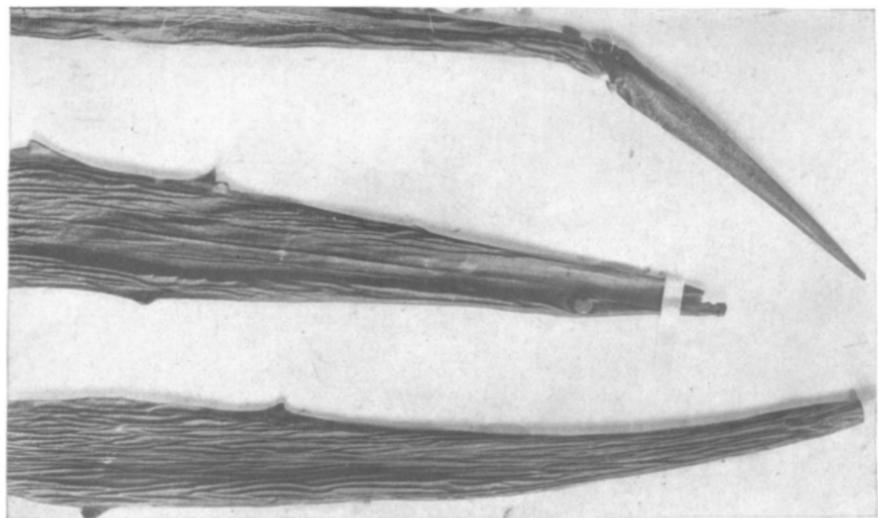
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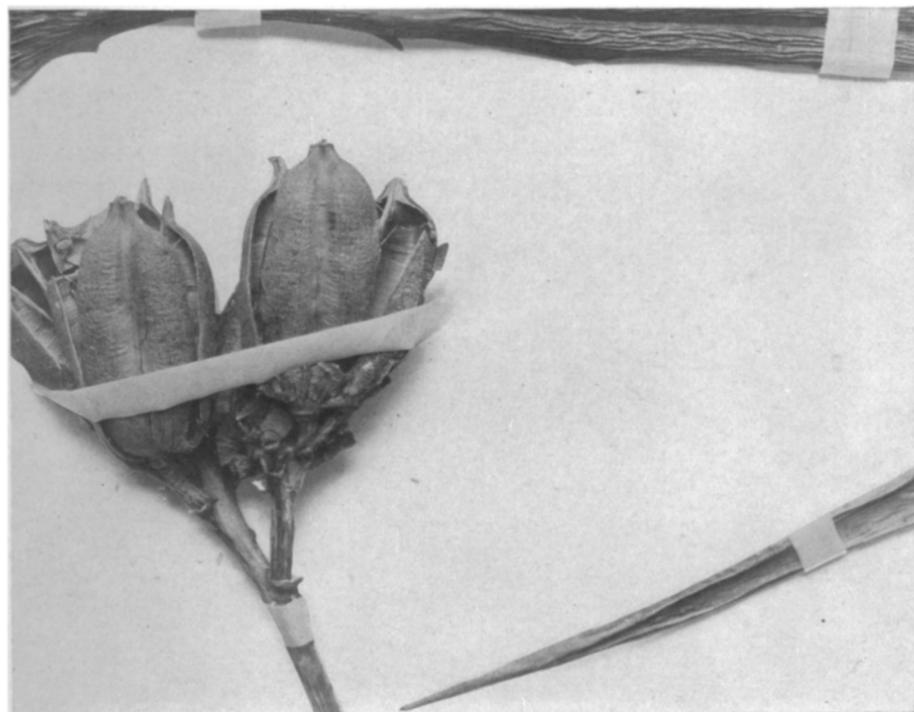
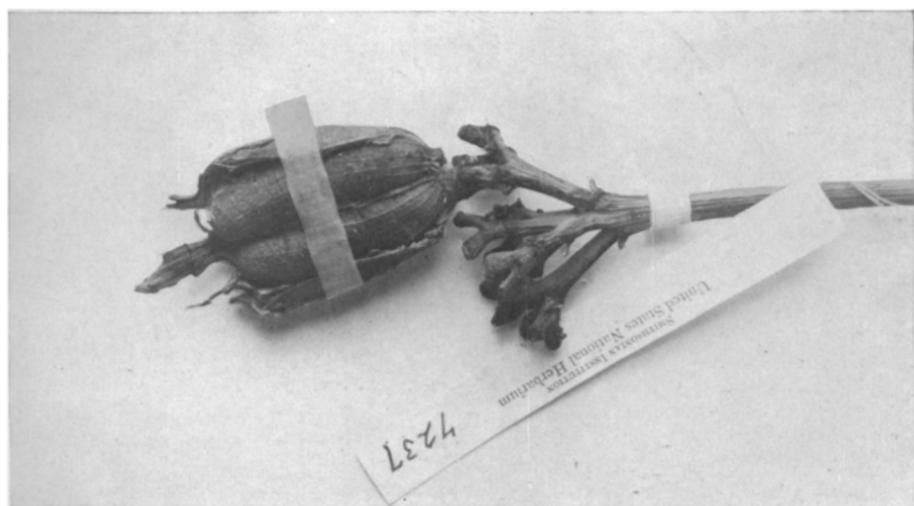
AGAVE DATYLO.



AGAVE VEXANS.



AGAVE VEXANS.



AGAVE VEXANS.